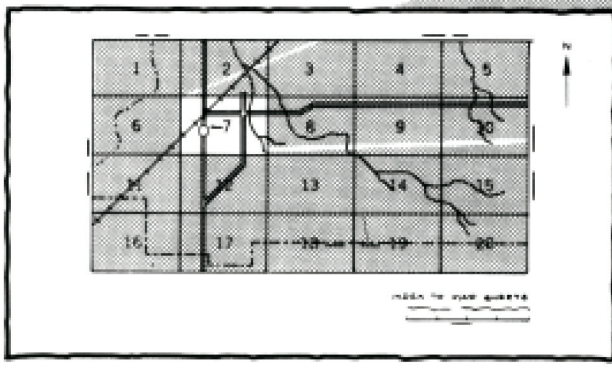
Soil Survey of

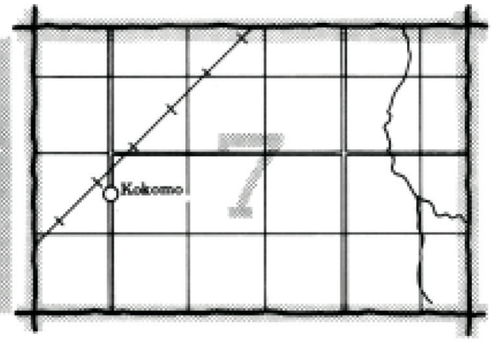
Cerro Gordo County, Iowa

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Iowa Agriculture and Home Economics Experiment Station
Cooperative Extension Service, Iowa State University
Department of Soil Conservation, State of Iowa

HOW TO USE

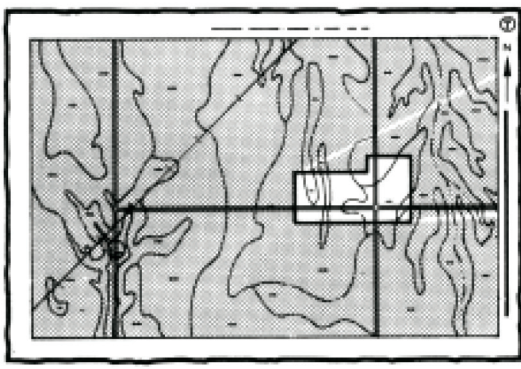
1. Locate your area of interest on the "Index to Map Sheets"

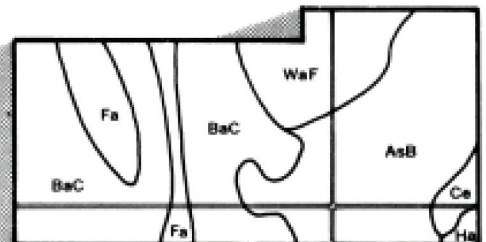




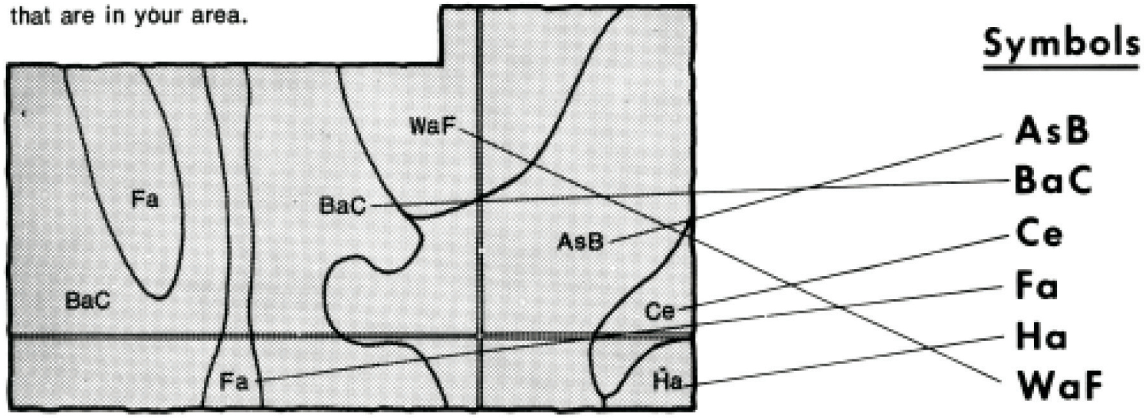
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



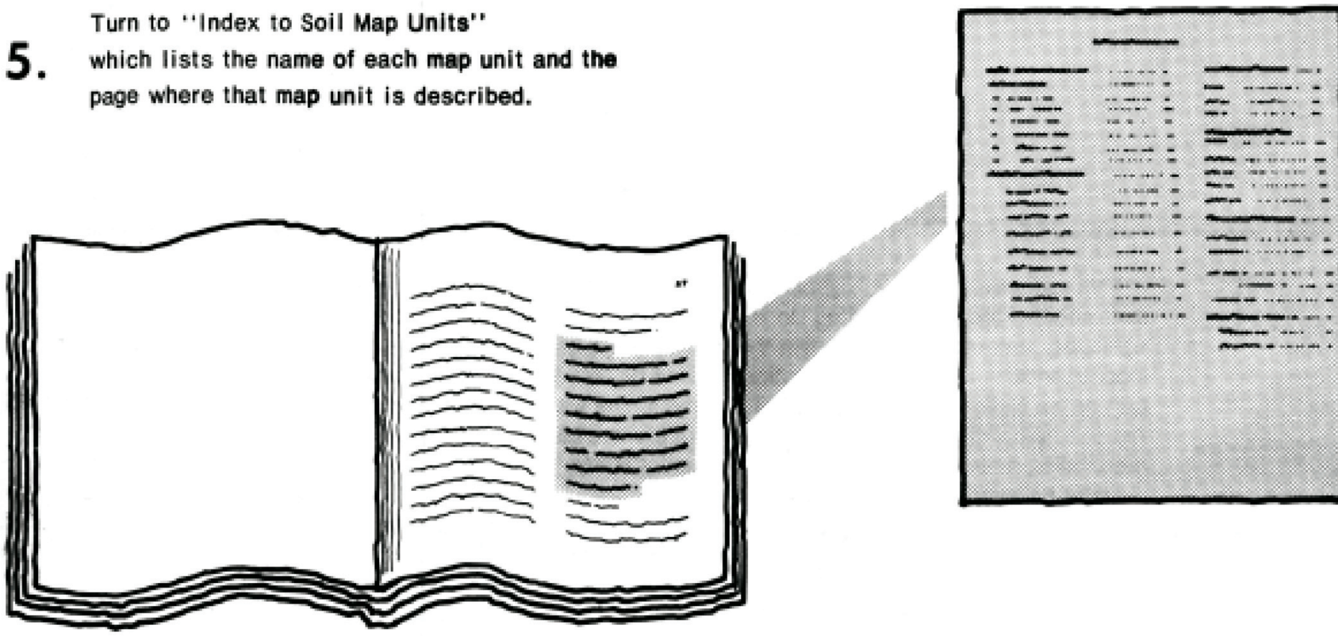


4. List the map unit symbols that are in your area.

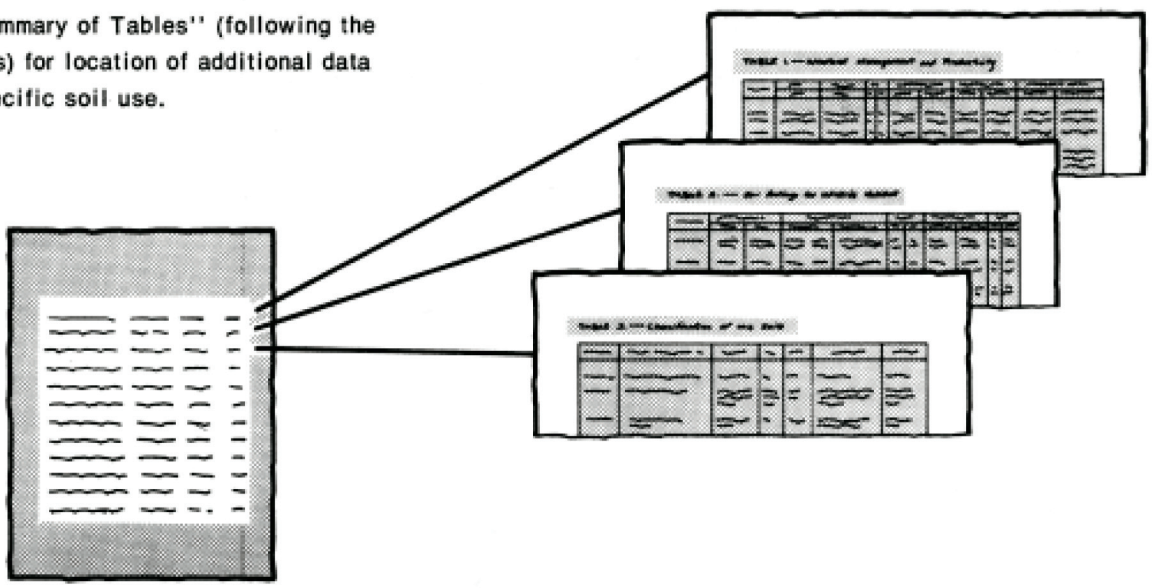


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1971-76. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service; Iowa Agriculture and Home Economics Experiment Station; Cooperative Extension Service, Iowa State University; and Department of Soil Conservation, State of Iowa. It is part of the technical assistance furnished to the Cerro Gordo County Soil Conservation District. Funds appropriated by Cerro Gordo County and the State of Iowa were used to pay part of the cost of the survey.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Grassed backslope with tile intake terraces on gently sloping Dinsdale soils.

contents

soil series

Issued October 1981

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summary of tables

preface

This soil survey contains information that can be used in land-planning programs in Cerro Gordo County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

soil survey of
Cerro Gordo County, Iowa

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United States Department of Agriculture, Soil Conservation Service
in cooperation with
Iowa Agriculture and Home Economics Experiment Station
Cooperative Extension Service, Iowa State University
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CERRO GORDO COUNTY is in north-central Iowa (fig. 1). Its area is 581 square miles, or 368,128 acres, and its population was 49,335 in 1970. Mason City is the county seat and largest city. It is near the center of the county and had a population of 30,491 in 1970.

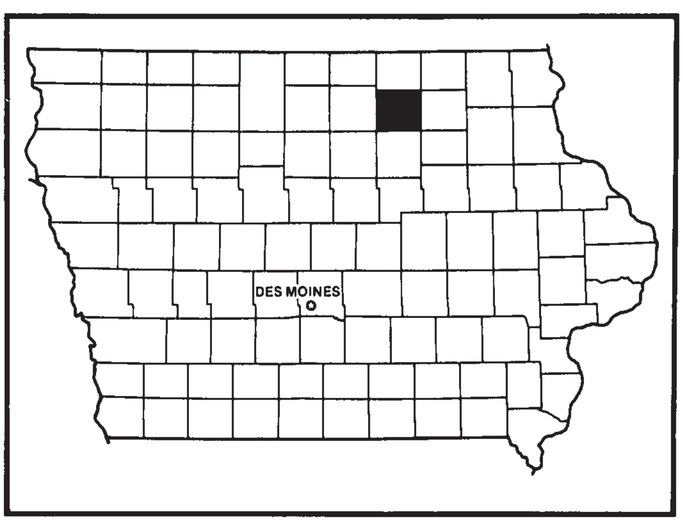

Figure 1.—Location of Cerro Gordo County in Iowa.

The county has a generally subdued land surface. The strongest relief occurs in areas adjacent to the Winnebago and Shellrock Rivers, which flow southeastward to the Mississippi River. Typical features of the topography on uplands are the generally flat horizon, low relief, and a gently undulating surface. Topography along the rivers is generally rough and hilly. In several localities the valley walls are sheer cliffs. In some areas, however, the rivers have well-developed benches and flood plains that are more than a mile wide. The highest altitude, about 1,310 feet, is in section 16 of Union township about 4 miles south of Clear Lake. The lowest altitude, about 1,010 feet, is in the eastern part of the county where the Winnebago River crosses the county boundary.

An earlier soil survey of Cerro Gordo County was published in 1940 (*10*). The present survey updates the earlier one and provides additional information and larger maps that show the soils in greater detail.

general nature of the county

This section gives general information concerning the county. It discusses farming, transportation, and industries.

The trend in recent years has been toward a decrease in the number, and an increase in the size, of farms in the county. The county in 1974 had a total of 1,146 farms occupying 339,852 acres. The average size was 297 acres. Livestock and cash grain farms are the most common. Crops are consumed by livestock on the farm or are sold.

In 1974, 77.3 percent of the land in Cerro Gordo County was owned by the operators and 22.7 percent was tenant operated. The proportion of land in owner-operated farms is higher than the state average, which was 72.6 percent.

Most of the cultivated acreage that is added to farms consists of former wetlands that have been drained. Nearly all of these added lands are depressions. A few small timbered areas have been cleared for crops.

Federal, state, and county highways provide routes for auto traffic and for the transportation of farm products. U.S. Highway 18 and Iowa Highway 106 cross the county east to west, and Iowa Highway 107, U.S. Highway 65, and Interstate 35 cross north to south. The many gravel and asphalt county roads enable farmers to come to the trading centers throughout the year. Bus transportation is available for some parts of the county. Railroads or motor freight lines serve most trading centers in the county.

Cerro Gordo County is used primarily for farming, but there are small industries in the numerous towns. Open-pit mining of limestone and shale provides raw materials for portland cement and for brick and tile industries in the county.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Mason City in the period 1951 to 1973. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 17 degrees F, and the average daily minimum temperature is 8 degrees. The lowest temperature on record, which occurred at Mason City on January 18, 1967, is -30 degrees. In summer the average temperature is 70 degrees, and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred at Mason City on June 29, 1970, is 102 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 30 inches. Of this, 23 inches, or 77 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 6.3 inches at Mason City on August 22, 1954. Thunderstorms occur on about 41 days each year, and most occur in summer.

Average seasonal snowfall is 37 inches. The greatest snow depth at any one time during the period of record was 27 inches. On an average of 40 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 84 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour in April.

Tornadoes and severe thunderstorms strike occasionally. These storms are local and short-lasting, and they cause sparse damage in narrow belts. Hailstorms occur at times during the warmer part of the year in irregular patterns and relatively small areas.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this

survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

soil descriptions

1. Saude-Marshan-Lawler association

Nearly level to moderately sloping, well drained, poorly drained, and somewhat poorly drained soils that formed in loamy and sandy alluvium; on stream benches and uplands

This association consists mostly of broad, nearly level to gently sloping stream benches; narrow, moderately sloping sandy and gravelly bench escarpments; and nearly level to gently rolling uplands (fig. 2). The soils formed in loamy alluvium over sand and gravel. All but the lowest stream terraces are usually free of flooding.

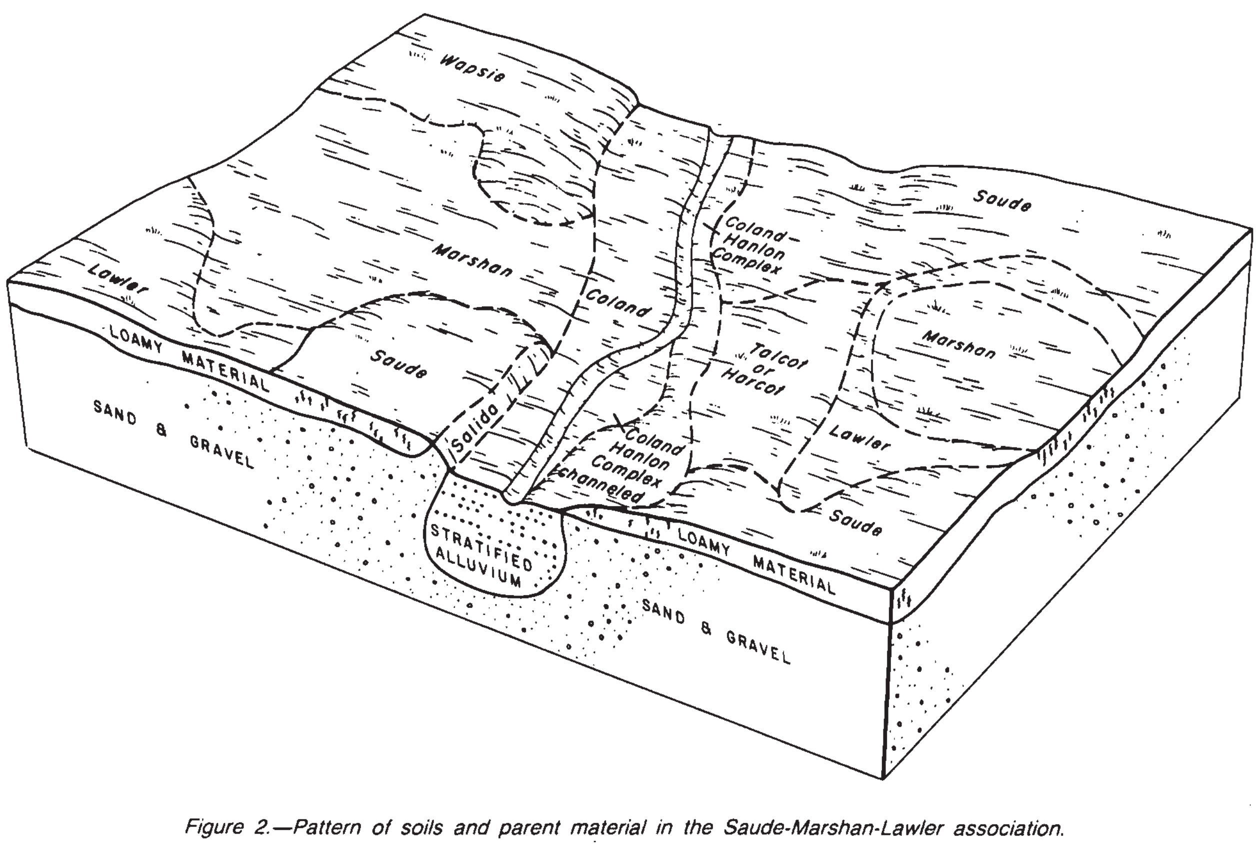

Figure 2.—Pattern of soils and parent material in the Saude-Marshan-Lawler association.

This association makes up about 14 percent of the county. It is about 35 percent Saude soils, 35 percent Marshan soils, 15 percent Lawler soils, and 15 percent less extensive soils.

Saude soils are on stream benches and uplands. They are well drained. The surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark brown loam about 7 inches thick. The subsoil is about 10 inches thick and is dark yellowish brown, friable loam in the upper part and dark yellowish brown, very friable sandy loam in the lower part. The substratum is loamy sand and gravelly coarse sand to a depth of about 72 inches.

Marshan soils are on stream benches and in alluvial areas on the uplands. They are nearly level and poorly drained. The surface layer is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 10 inches thick. The subsoil is olive gray, friable loam about 10 inches thick. The substratum is gray and grayish brown gravelly coarse sand and sand to a depth of about 60 inches.

Lawler soils are on stream benches and in alluvial areas on the uplands. They are nearly level and somewhat poorly drained. The surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 8 inches thick. The subsoil is about 12 inches thick. It is dark grayish brown loam in the upper part; grayish brown and light olive brown loam in the middle part; and grayish brown, light olive brown, and light brownish gray sandy loam in the lower part. The substratum is olive brown and yellowish brown gravelly coarse sand to a depth of about 60 inches.

Less extensive in this association are the poorly drained Coland, Talcot, and Harcot soils; the well drained Wapsie soils; the excessively drained Salida soils; and the Coland-Hanlon complex. Coland and Hanlon soils are on bottom lands and are subject to flooding. Talcot and Harcot soils are similar to Marshan soils in color, texture, and landscape position but are calcareous. Wapsie soils are on stream benches and uplands. Salida soils are shallow to calcareous sand and gravel.

Most of the soils on benches are used for cultivated crops and are well suited to them. Available water capacity is moderate or low. The soils on benches are possible sources of sand and gravel.

Some areas of this association need drainage. Most areas of Marshan soils need subsurface drains. Other areas of this association need control of erosion. Some areas are droughty. All of the major soils in this association need fertilizer.

2. Dinsdale-Klinger-Maxfield association

Nearly level to gently sloping, well drained, somewhat poorly drained, and poorly drained soils that formed in loess and the underlying glacial till; on uplands

This association is characterized by long slopes and slightly rounded ridges; broad, nearly level areas; and a well developed drainage network (fig. 3). Most of the soils formed in 20 to 40 inches of loess and the underlying glacial till.

This association makes up about 4 percent of the county. It is about 35 percent Dinsdale soils, 30 percent Klinger soils, 25 percent Maxfield soils, and 10 percent less extensive soils.

Dinsdale soils are on the sides and crests of ridges and have long, uniform slopes. They are slightly higher than the Klinger soils. Dinsdale soils are nearly level to gently sloping and are well drained. The surface layer is black silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 9 inches thick. The subsoil is about 33 inches thick and is dark yellowish brown silty clay loam in the upper part and yellowish brown loam in the lower part. The substratum is yellowish brown loam to a depth of about 60 inches.

Klinger soils are on the sides and crests of ridges. Slopes are long and uniform. These soils are slightly higher than the Maxfield soils. Klinger soils are very gently sloping and somewhat poorly drained. The surface layer is black silty clay loam about 8 inches thick. The subsurface layer is also black silty clay loam about 7 inches thick. The subsoil is about 31 inches thick and is dark grayish brown silty clay loam in the upper part, dark yellowish brown and dark grayish brown silty clay loam in the middle part, and yellowish brown loam in the lower part. The substratum is yellowish brown loam to a depth of about 60 inches.

Maxfield soils are in broad upland areas and drainageways. They are nearly level and poorly drained. The surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 12 inches thick. The subsoil is about 26 inches thick and is mottled dark gray and olive, friable silty clay loam and heavy silt loam in the upper part and strong brown, mottled, firm loam in the lower part. The substratum is strong brown, mottled loam to a depth of about 60 inches.

Less extensive in this association are the well drained Bolan soils, the moderately well drained to somewhat poorly drained Donnan soils, the poorly drained Canisteo soils, and the somewhat excessively drained Dickinson soils. Nearly level to gently sloping Bolan and Dickinson soils are on mounds, in dunelike areas, and on the sides and crests of ridges. Nearly level to moderately sloping Donnan soils are generally in the higher positions and on some of the steeper side slopes. Canisteo soils are generally on the lowest part of the landscape.

Nearly all of this association is used for row crops and is well suited to them. Available water capacity is high.

Most areas of the poorly drained soils and some areas of the somewhat poorly drained soils have been drained, but some areas still need drainage. Steeper soils need control of water erosion. Slopes are long and uniform and are well suited to contouring and terracing.

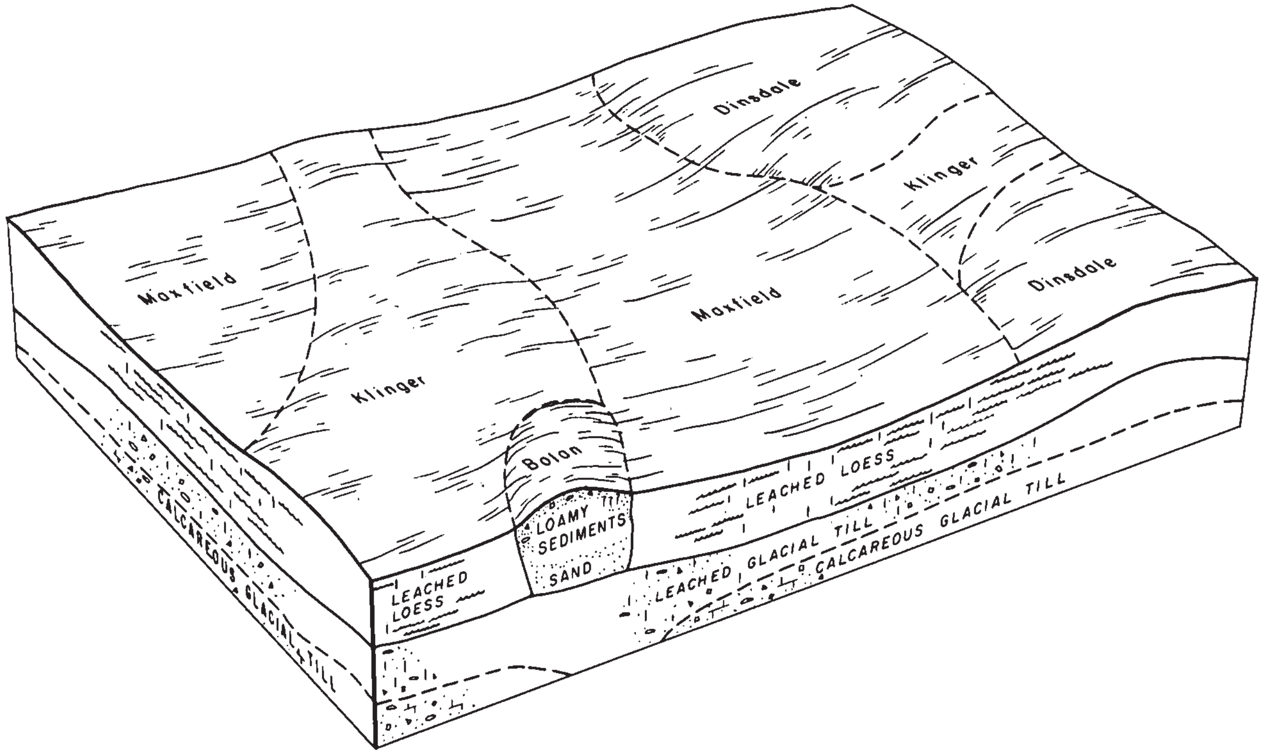

Figure 3.—Pattern of soils and parent material in the Dinsdale-Klinger-Maxfield association.

Protection against wind erosion is needed in some areas.

3. Rockton-Sogn-Mottland association

Nearly level to very steep, well drained and somewhat excessively drained soils that formed in loamy sediment over limestone bedrock; on stream benches and uplands

This association is mostly gently sloping and moderately sloping. The areas are dissected by small streams and drainageways (fig. 4). Some of the lower areas are susceptible to flooding.

This association makes up about 5 percent of the county. It is about 32 percent Rockton soils, 30 percent Sogn soils, 15 percent Mottland soils, and 23 percent less extensive soils.

Rockton soils are on the sides and crests of ridges in higher areas on the stream benches and uplands. They are nearly level to moderately sloping and are well drained. The surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 21 inches thick and is brown clay loam and sandy clay loam in the upper part and reddish brown clay in the lower part. Limestone bedrock is at a depth of 34 inches.

Sogn soils are on escarpments and crests of ridges on uplands and on stream benches. They are gently sloping to moderately steep and are somewhat excessively drained. The surface layer is dark brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. Limestone bedrock is at a depth of 11 inches.

Mottland soils are on sides and crests of ridges. They are gently sloping to very steep and are well drained. The surface layer is very dark grayish brown loam about 8 inches thick. The substratum is yellowish brown and light yellowish brown channery loam and channery fine sandy loam to a depth of about 60 inches.

Less extensive in this association are the poorly drained Calamine, Faxon, Tilfer, and Coland soils; the somewhat poorly drained Jacwin and Kensett soils; the well drained Rossfield soils; and the moderately well drained Terril soils. Nearly level Tilfer and Faxon soils are in low areas on stream benches and have smooth to slightly concave slopes. Nearly level Kensett soils are on stream benches and uplands and have slightly convex to slightly concave slopes. Calamine and Jacwin soils have a silty clay shale substratum; they are on stream benches and uplands and in areas below Mottland and Rossfield soils. Terril soils are on foot slopes and alluvial fans below the more sloping areas. Coland soils are on bottom lands along streams and along some upland drainageways.

Row crops are grown on the nearly level to gently sloping uplands and on the greater part of the stream benches. The moderately sloping to very steep areas are

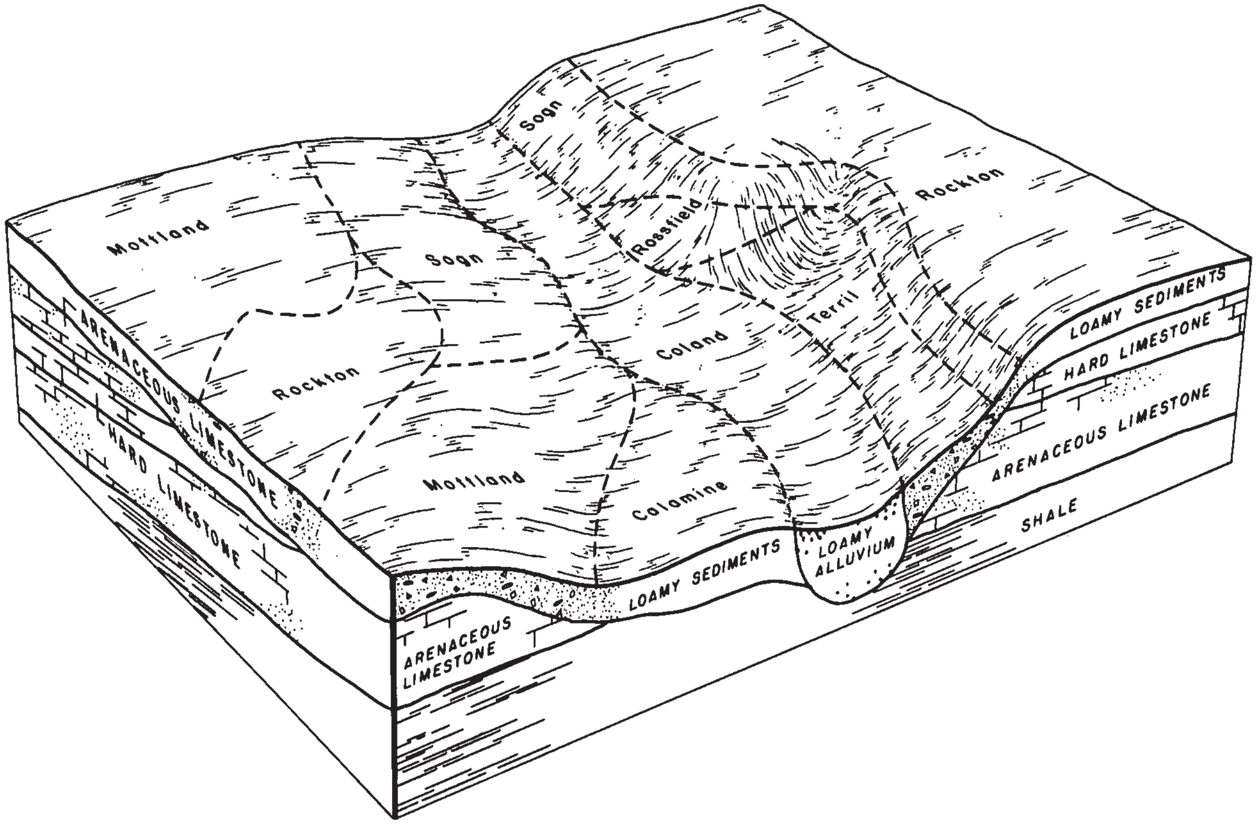

Figure 4.—Pattern of soils and parent material in the Rockton-Sogn-Mottland association.

generally in pasture or woodland. Near Mason City, shale and limestone are mined for portland cement. This association is a good source of limestone, but water has to be pumped from most quarries.

Rockton, Sogn, and Mottland soils are droughty unless rainfall is timely. These soils are susceptible to slight water erosion, and a few steep areas are moderately eroded. In Sogn and Mottland soils bedrock is above a depth of 20 inches and crops out in places. In many places on stream benches the water table is within a few feet of the surface. Limestone is generally at a depth of less than 3 feet and interferes with construction of roads and buildings.

4. Lester-Webster-Nicollet association

Nearly level to steep, well drained, poorly drained, and somewhat poorly drained soils that formed in glacial till and local alluvium derived from glacial till; on uplands

This association consists of nearly level and gently sloping areas mixed with moderately sloping to steep areas (fig. 5). Slopes are short and complex. There are many depressions; some are used for crops, and others are marshy and are left idle.

This association makes up about 13 percent of the county. It is about 45 percent Lester soils, 20 percent Webster soils, 15 percent Nicollet soils, and 20 percent less extensive soils.

Lester soils are in the higher, more sloping areas. They are well drained. The surface layer is very dark gray loam about 8 inches thick. The subsoil is about 30 inches thick. It is brown, friable clay loam in the upper part; dark yellowish brown, friable clay loam in the middle part; and dark yellowish brown, friable loam in the lower part. The substratum is light olive brown and yellowish brown loam to a depth of about 60 inches.

Webster soils are in low areas and in the smaller drainageways. They are nearly level and poorly drained. The surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 9 inches thick. The subsoil is very dark gray, dark gray, and olive gray, friable silty clay loam and clay loam about 20 inches thick. The substratum is light olive gray clay loam to a depth of about 60 inches.

Nicollet soils are in intricate patterns on the landscape with Webster soils. They are very gently sloping and somewhat poorly drained. The surface layer is black loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 15 inches thick. The

subsoil is mottled dark grayish brown and olive brown, friable loam about 5 inches thick. The substratum is light olive brown loam to a depth of about 60 inches.

Less extensive in this association are the well drained Wapsie soils; the moderately well drained Kilkenny soils; the poorly drained Canisteo and Harps soils; the very poorly drained Okoboji, Houghton, and Palms soils; and the somewhat poorly drained Le Sueur soils. Very gently sloping Harps soils are on rims of depressions. Okoboji, Houghton, and Palms soils are in depressions. Le Sueur soils are in low areas and in the smaller drainageways, and Kilkenny and Wapsie soils are in the higher, more sloping areas.

Most of this association is used for crops. A few small areas are timbered, and some of the acreage is in permanent pasture or marsh.

The nearly level to gently sloping soils are well suited to row crops if the soils are properly drained and if erosion is controlled. Some of the steeper soils are not well suited to row crops and are better suited to pasture or woodland. Available water capacity is high. Most of the marshy areas are useful only for wildlife habitat.

Controlling water erosion and removing excess water are the major management concerns. Contouring and terracing are complicated by the irregular topography. Most areas of the poorly drained Webster soils have been drained.

5. Clarion-Webster-Nicollet association

Nearly level to strongly sloping, well drained, poorly drained, and somewhat poorly drained soils that formed in glacial till and local alluvium derived from glacial till; on uplands

This association is mostly nearly level to strongly sloping. A few areas are moderately steep and steep. Most slopes are short and complex (fig. 6). There are many depressions; some are in crops, and others are marshy.

This association makes up about 26 percent of the county. It is about 40 percent Clarion soils, 28 percent Webster soils, 12 percent Nicollet soils, and 20 percent less extensive soils.

Clarion soils are in the higher, more sloping areas. They are nearly level to strongly sloping and are well drained. The surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is brown and dark yellowish brown, friable loam about 23 inches thick. The substratum is light olive brown loam to a depth of about 63 inches.

Webster soils are in low areas and drainageways. They are nearly level and poorly drained. The surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 9 inches

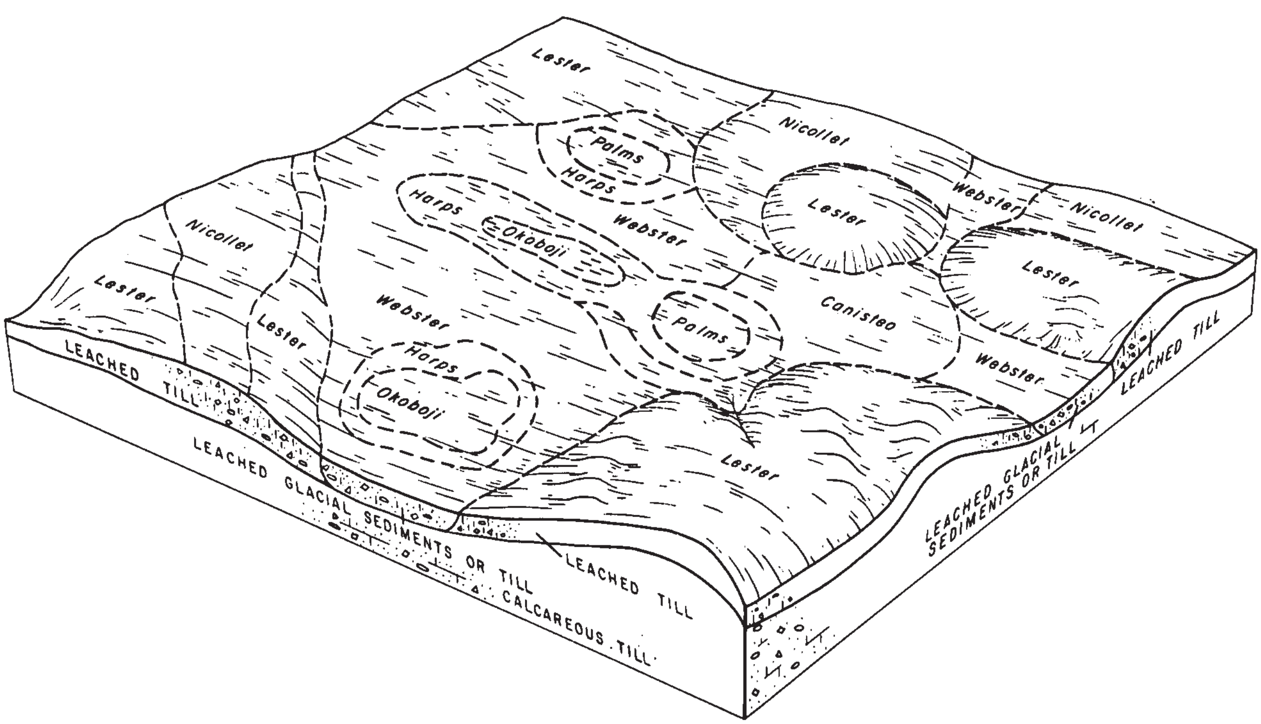

Figure 5.—Pattern of soils and parent material in the Lester-Webster-Nicollet association.

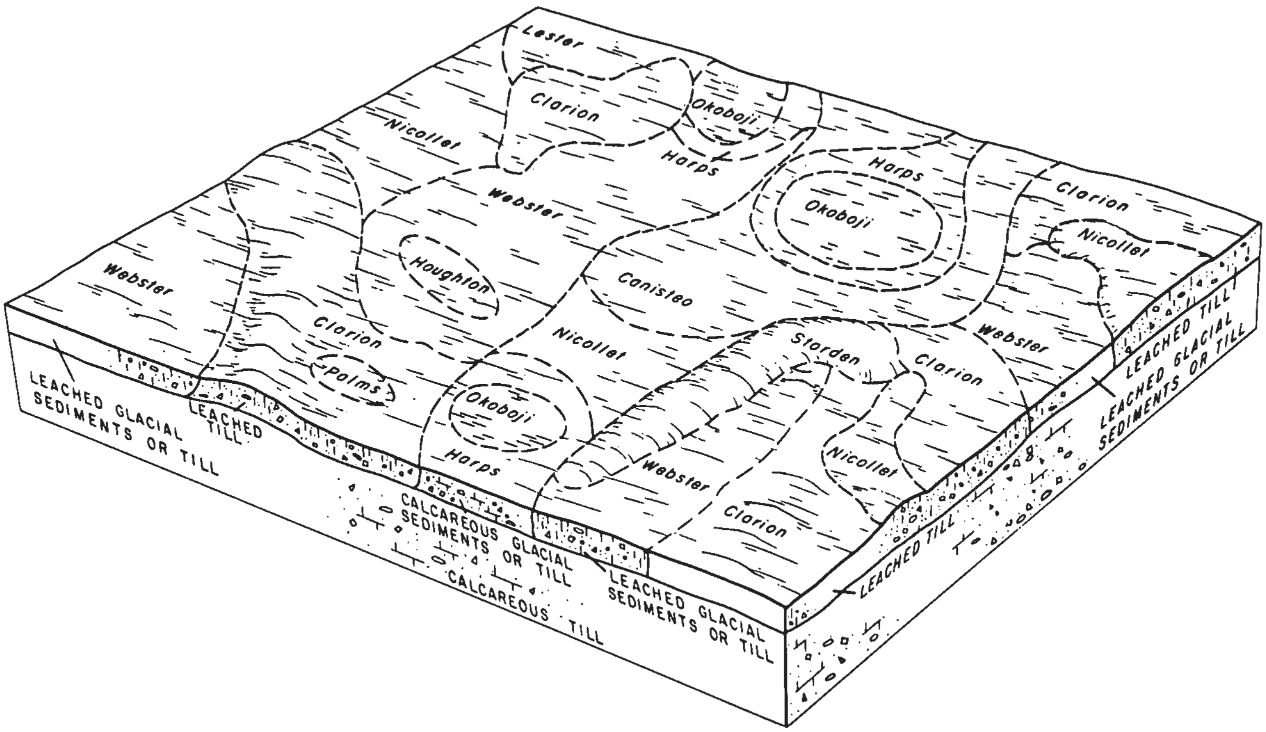

Figure 6.—Pattern of soils and parent material in the Clarion-Webster-Nicollet association.

thick. The subsoil is very dark gray, olive gray, and dark gray, friable silty clay loam and clay loam and is about 20 inches thick. The substratum is light olive gray clay loam to a depth of about 60 inches.

The Nicollet soils are very gently sloping and somewhat poorly drained. The surface layer is black loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 15 inches thick. The subsoil is mottled dark grayish brown and olive brown, friable loam about 6 inches thick. The substratum is light olive brown loam to a depth of about 60 inches.

Less extensive in this association are well drained Lester, Saude, and Storden soils; very poorly drained Okoboji, Houghton, and Palms soils; and poorly drained Canisteo and Harps soils. Lester and Saude soils are in higher, more sloping parts of the association. Storden soils are on knobs and narrow ridges. Canisteo soils are in low areas and drainageways. Harps soils are very gently sloping and are on rims of depressions. Okoboji, Houghton, and Palms soils are in depressions.

Nearly all of this association is used for row crops. A few areas are timbered or in permanent pasture.

Most of this association is well suited to row crops if the soils are properly drained and if erosion is controlled. The available water capacity is high. Okoboji, Houghton, and Palms soils are moderately suited to row crops if properly drained, but they are susceptible to wetness and ponding after heavy rains and spring thaw. A few steep areas and some sloping, gravelly areas are not suited to row crops. Nearly all of the sloping areas are generally well suited to farm ponds.

Controlling water erosion and removing excess water from the nearly level areas and depressions are the major management concerns. Contouring and terracing are complicated by the irregular topography. Most areas of the poorly drained Webster soils have been drained.

6. Clarion-Nicollet association

Gently sloping and very gently sloping, well drained and somewhat poorly drained soils that formed in glacial till; on uplands

This association is characterized by long slopes, slightly rounded ridges, and a well developed drainage network (fig. 7). There are no depressions.

This association makes up about 2 percent of the county. It is about 45 percent Clarion soils, 30 percent Nicollet soils, and 25 percent less extensive soils.

Clarion soils are in the higher areas. Slopes are long and uniform. These soils are gently sloping and well drained. The surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam 5 inches thick. The subsoil is brown and

dark yellowish brown, friable loam about 23 inches thick. The substratum is light olive brown loam to a depth of about 63 inches.

Nicollet soils are lower on the landscape than the Clarion soils. Slopes are long and uniform. Nicollet soils are very gently sloping and somewhat poorly drained. The surface layer is black loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 15 inches thick. The subsoil is mottled dark grayish brown and olive brown, friable loam about 6 inches thick. The substratum is light olive brown loam to a depth of about 60 inches.

Less extensive in this association are the poorly drained Canisteo, Webster, Harps, Marshan, and Talcot soils. These nearly level soils are along drainageways that receive runoff from broad areas of long, uniform slopes.

All but a very small part of this association is used for row crops.

The soils in this association are well suited to row crops. Available water capacity is high throughout. The soils are well suited to farm ponds, but only a few good sites are available because of position on the landscape.

Clarion soils and the more sloping Nicollet soils need control of water erosion. All of the soils are well suited to contouring and terracing.

7. Clyde-Kenyon-Floyd association

Nearly level to moderately sloping, poorly drained, moderately well drained, and somewhat poorly drained soils that formed in loamy surficial sediment and the underlying glacial till; on uplands and in drainageways

This association is characterized by long slopes, slightly rounded ridges, and a well developed drainage network (fig. 8).

This association makes up about 30 percent of the county. It is about 30 percent Clyde soils, 20 percent Kenyon soils, 17 percent Floyd soils, and 33 percent less extensive soils.

Clyde soils are in drainageways. In a few places they are in relatively large areas that have a few defined drainageways. Clyde soils are frequently flooded for brief periods. They are nearly level and poorly drained. The surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black, dark grayish brown, and very dark gray silty clay loam about 12 inches thick. The subsoil is about 28 inches thick. It is olive gray, friable clay loam in the upper part; yellowish brown, very friable sandy loam in the middle part; and mottled gray and dark gray, friable clay loam in the lower part. The

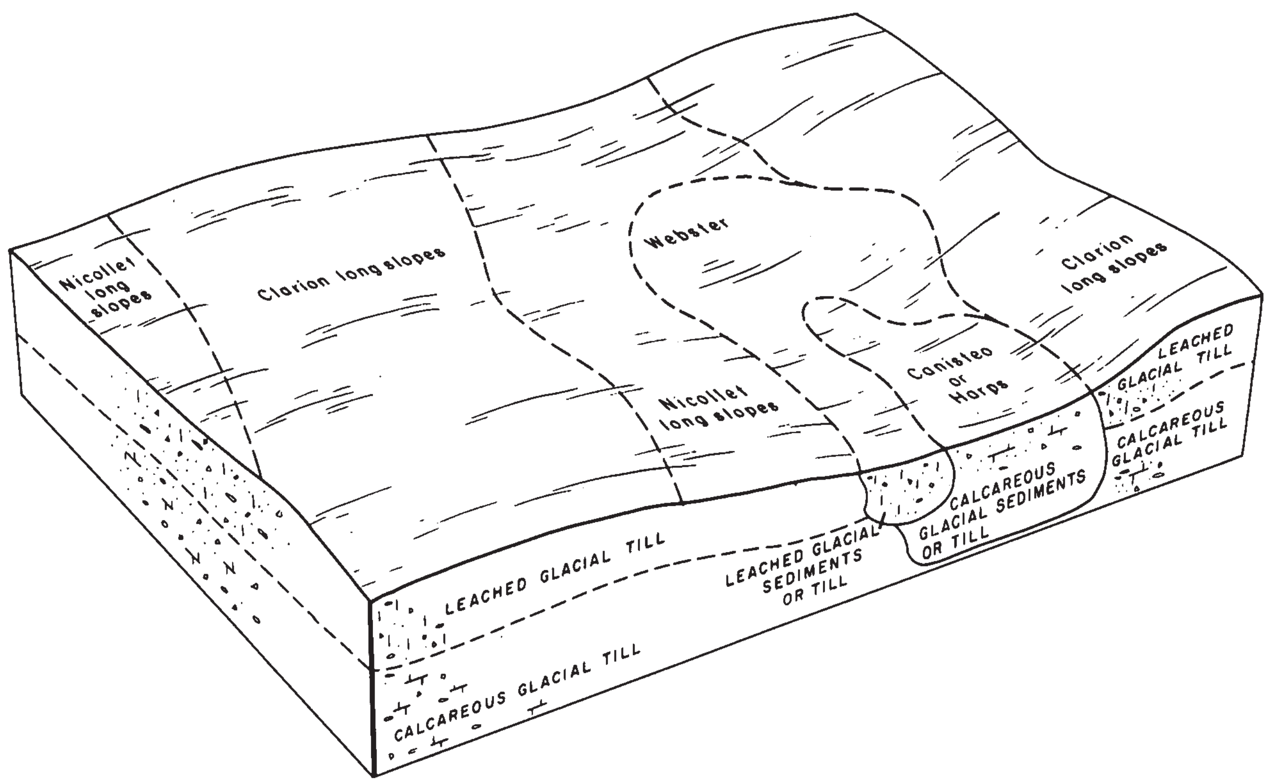

Figure 7.—Pattern of soils and parent material in the Clarion-Nicollet association.

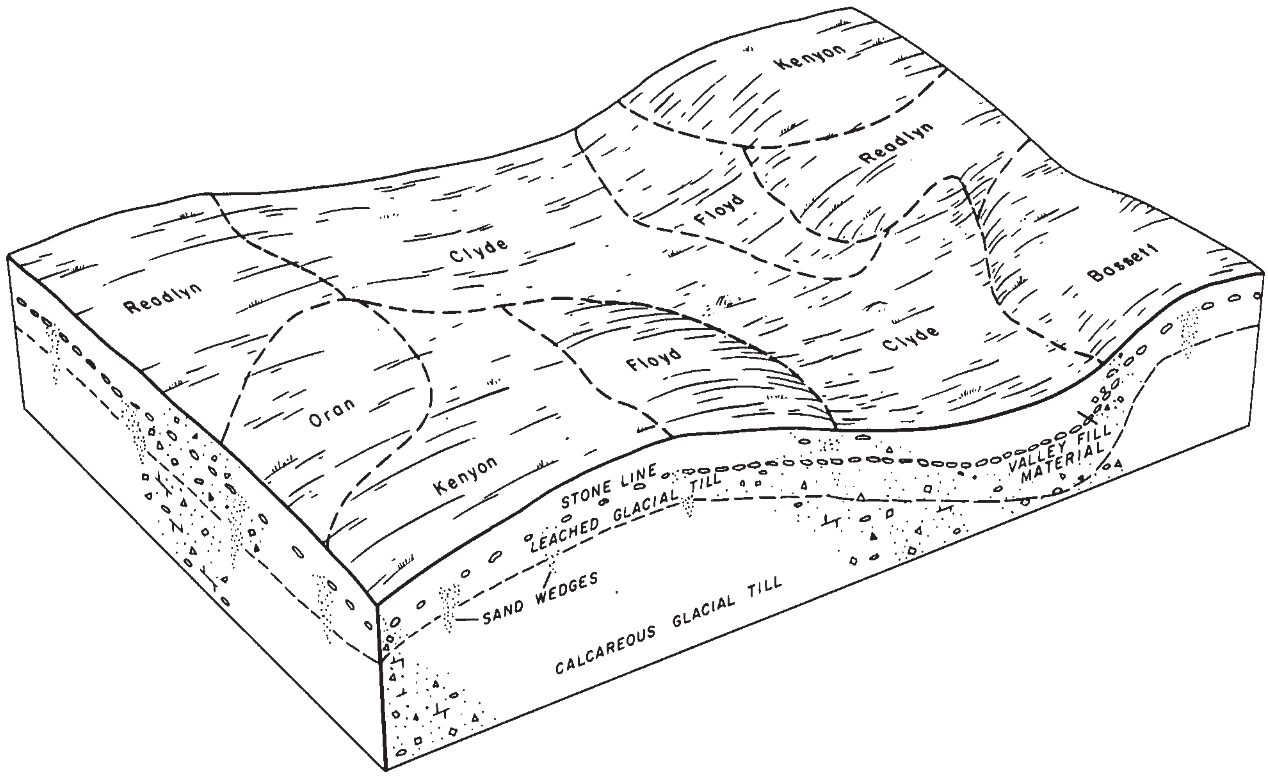

Figure 8.—Pattern of soils and parent material in the Clyde-Kenyon-Floyd association

substratum is yellowish brown and gray loam to a depth of about 72 inches.

Kenyon soils are in the higher, generally more sloping areas. Most slopes are long and uniform. Kenyon soils are gently sloping and moderately sloping and are moderately well drained. The surface layer is black loam about 8 inches thick. The subsurface layer is black and dark brown loam about 13 inches thick. The subsoil is about 25 inches thick. It is brown, friable loam in the upper part; dark yellowish brown, friable loam in the middle part; and dark yellowish brown, friable loam in the lower part.

Floyd soils are on very gently sloping and gently sloping uplands and are somewhat poorly drained. Slopes are long and uniform. The surface layer is black loam about 8 inches thick. The subsurface layer is black clay loam about 13 inches thick. The subsoil is about 21 inches thick. It is olive brown, friable clay loam in the upper part; yellowish brown, friable sandy clay loam in the middle part; and mottled yellowish brown and grayish brown, friable sandy clay loam in the lower part. The substratum is light brownish gray and strong brown loam to a depth of about 60 inches.

Less extensive in this association are the moderately well drained Bassett soils, the somewhat poorly drained to moderately well drained Donnan soils, and the somewhat poorly drained Schley, Oran, and Readlyn soils. Bassett and Donnan soils are in the higher, generally more sloping parts of the association. Schley soils are in slightly concave areas downslope from Bassett and Donnan soils. Nearly level and very gently sloping Readlyn soils make up about 3 percent of the unit. They are on the sides and crests of ridges and have long, uniform slopes.

Nearly all of this association is used for row crops.

Most of the soils in this association are well suited to row crops. Available water capacity is high. The soils are generally well suited to farm ponds.

Most areas of the poorly drained soils and some areas of the somewhat poorly drained soils have been drained, but some areas still need drainage. The steeper soils need control of water erosion. Some areas need protection against wind erosion.

8. Rossfield-Rockton-Ripon association

Nearly level to moderately sloping, well drained soils that formed in loess or in loamy glacial sediment over limestone bedrock; on uplands

This association is generally characterized by broad, nearly level ridge crests and gently sloping to moderately sloping side slopes (fig. 9).

This association makes up about 6 percent of the county. It is about 30 percent Rossfield soils, 25 percent Rockton soils, 15 percent Ripon soils, and 30 percent less extensive soils.

Rossfield soils are on crests and sides of ridges. In many places they are in relatively large areas that have few defined drainageways. Rossfield soils are nearly level to moderately sloping. The surface layer is very dark brown silt loam about 9 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil is about 16 inches thick and is very dark grayish brown and yellowish brown, friable silty clay loam in the upper part and yellowish brown, friable clay loam in the lower part. The substratum is brownish yellow and olive yellow channery loam.

Rockton soils are on crests and sides of ridges. They are nearly level and gently sloping. The surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 21 inches thick and is brown, friable clay loam and sandy clay loam in the upper part and reddish brown, firm clay in the lower part. Hard limestone bedrock is at a depth of 34 inches.

Ripon soils are on crests and sides of ridges. They are nearly level and gently sloping. The surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is about 22 inches thick and is dark yellowish brown and brown, friable silty clay loam in the upper part and dark yellowish brown and strong brown, friable clay loam and clay in the lower part. Hard limestone bedrock is at a depth of about 36 inches.

Less extensive in this association are well drained and moderately well drained Dinsdale soils and moderately well drained Kenyon soils. These soils are on the summits of upland watershed divides where depth to limestone is commonly 5 to 20 feet.

Nearly all of this association is used for row crops.

Most of the soils in this association are well suited to row crops if erosion is controlled. This associaton is a good source of limestone. Water is generally below a depth of 6 feet and does not interfere with mining.

Most of the soils are subject to drought when rainfall is below normal. The bedrock limits rooting depth and available water capacity. Terrace cuts should be minimized to avoid exposing the underlying limestone. Broad, nearly level areas are subject to wind erosion if plowed in fall.

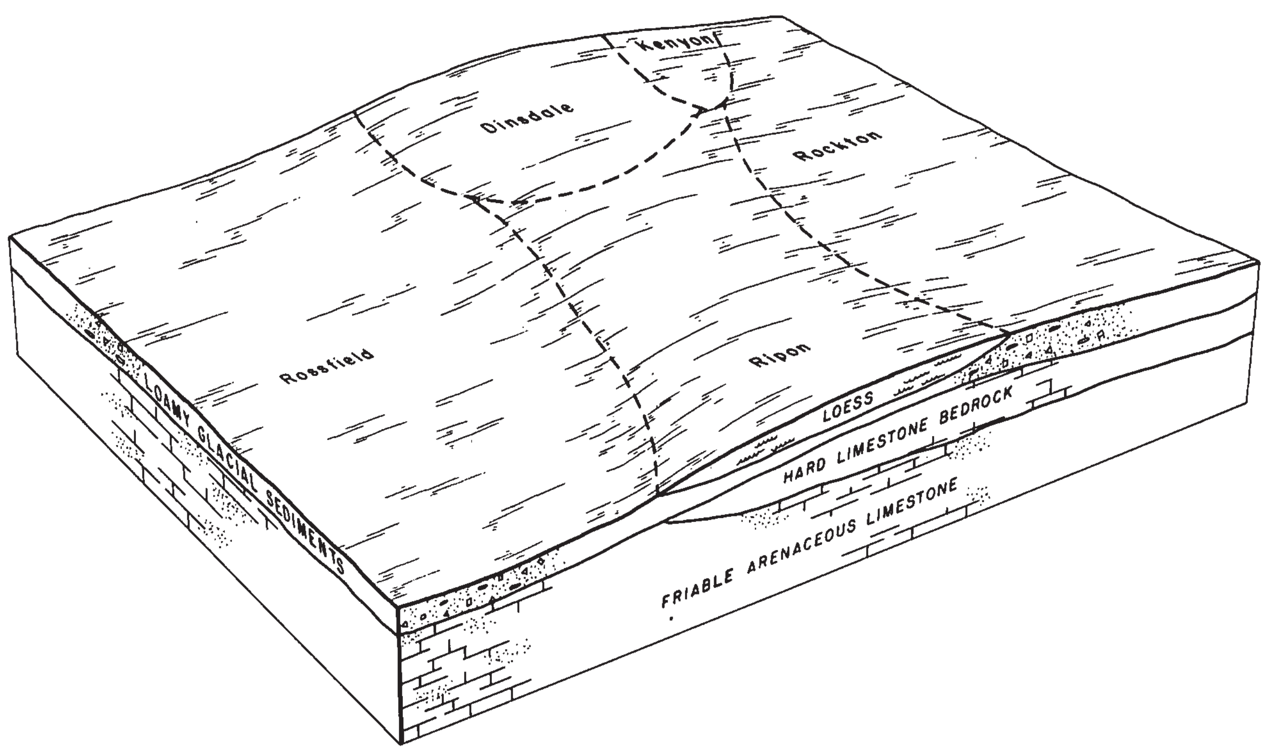

Figure 9.—Pattern of soils and parent material in the Rossfield-Rockton-Ripon association.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Clarion loam, 5 to 9 percent slopes, moderately eroded, is one of several phases in the Clarion series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Clyde-Floyd complex, 1 to 4 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Aquolls and Histosols is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, clay, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

6—Okoboji silty clay loam, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in depressions on glacial till uplands. Slopes are short and concave. This soil is subject to ponding.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 21 inches thick. The subsoil is olive gray, friable silty clay loam to a depth of about 46 inches. The substratum is olive gray, calcareous silty clay loam to a depth of about 60 inches. A few areas have a mucky silt loam surface layer.

Included with this soil in mapping are some small areas of a Harps soil on low knolls or rims. This soil is calcareous. Excess lime adversely affects the response of crops to herbicides and fertilizer. The Harps soil makes up less than 10 percent of the map unit.

This Okoboji soil has high available water capacity. Permeability is moderately slow. This soil has a seasonal high water table and is ponded after heavy rains. The surface layer becomes cloddy and puddled if this soil is tilled when wet. Shrink-swell potential is high. This soil is neutral or mildly alkaline and does not need lime. The surface layer contains about 10 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil have been drained and are cultivated. Most undrained areas are used for pasture or wetland wildlife habitat. If drained, this soil is moderately suited to corn, soybeans, and other cultivated crops; to small grains; and to grasses for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

Ponding and wetness limit crop production. Surface water intakes or surface drains minimize crop damage from ponding. There is a danger of early frost in fall.

If undrained areas of this soil are used for pasture, tilth of the surface layer is easily damaged by trampling by livestock. Stocking or grazing should be restricted during wet periods. Many legumes are winter-killed or drown in spring. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

27B—Terril loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on slightly concave foot slopes and on convex alluvial fans on the uplands. Individual areas are long and narrow and range from 2 to 10 acres in size.

Typically, the surface layer is black loam about 13 inches thick. The subsurface layer is about 17 inches thick and is black loam in the upper part and very dark brown clay loam in the lower part. The subsoil extends to a depth of 48 inches. It is dark brown, friable clay loam in the upper part and dark yellowish brown, friable sandy clay loam in the lower part. The substratum is yellowish brown loam to a depth of about 74 inches.

Included with this soil in mapping are small areas of steeper Terril loam. These areas make up less than 5 percent of the map unit.

This Terril soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is good. Reaction is slightly acid or neutral in the plow layer, depending on past liming practices. The subsoil is neutral or slightly acid. The plow layer contains about 5 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is well suited to use for sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

29—Clarion-Nicollet loams, 1 to 3 percent slopes. This complex consists of very gently sloping, well drained and somewhat poorly drained soils on low knolls and in swales and upland drainageways. Slopes are short. Individual areas range from 2 to 50 acres in size. This complex is typically about 60 percent Clarion soil and 40 percent Nicollet soil. The Clarion soil is on the more sloping convex knolls. The Nicollet soil is in the concave parts of swales and heads of drainageways. Areas of these soils are so intricately mixed or so small in size that it was not practical to separate them in mapping.

Typically, the Clarion soil has a surface layer of very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is brown, friable loam; and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown, calcareous loam to a depth of 63 inches.

Typically, the Nicollet soil has a surface layer of black loam about 8 inches thick. The subsurface layer is black loam in the upper part and very dark grayish brown loam in the lower part and is about 15 inches thick. The subsoil is mottled dark grayish brown and olive brown, friable loam about 6 inches thick. The substratum is light olive brown, calcareous loam to a depth of about 60 inches.

Included with these soils in mapping in lower areas are small areas of poorly drained Webster soils and small depressions that pond water. These areas make up less than 10 percent of the map unit.

These Clarion and Nicollet soils have high available water capacity. Permeability is moderate. Surface runoff is slow. The Nicollet soil has a seasonal high water table during wet periods. Tilth is typically good. The surface layer and subsoil are typically neutral or slightly acid. The Clarion soil contains about 4 percent organic matter in the surface layer, and the Nicollet soil contains 5 percent. The subsoil is very low in available phosphorus and potassium.

Most areas of these soils are cultivated. These soils are well suited to corn, soybeans, and other cultivated crops and to small grains. They are also well suited to grasses and legumes for hay and pasture. These soils are moderately suited to use for most sanitary facilities and building sites.

If these soils are cultivated, the more sloping Clarion soil has a slight hazard of erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If these soils are used for pasture, overgrazing or grazing when the soil is too wet causes surface

compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This complex is in capability class I.

41B—Sparta loamy fine sand, 2 to 5 percent slopes. This gently sloping, excessively drained soil is on convex ridge crests on the uplands and on stream benches. Individual areas are long and narrow and range from 2 to 10 acres.

Typically, the surface layer is very dark brown loamy fine sand about 7 inches thick. The subsurface layer is about 12 inches thick. It is very dark brown loamy fine sand in the upper part and very dark grayish brown loamy fine sand in the lower part. The subsoil extends to a depth of 35 inches. The upper part of the subsoil is dark yellowish brown, friable loamy fine sand; and the lower part is yellowish brown, loose fine sand. The substratum is brown and yellowish brown fine sand to a depth of about 60 inches.

Included with this soil in mapping are small areas of soils that have a thin brown surface layer. These areas are mostly in timber; some are cultivated and eroded. They make up less than 5 percent of the map unit.

This Sparta soil has low available water capacity and is droughty. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Surface runoff is slow. Tilth is good. This soil is generally acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 1 percent organic matter. The subsoil is very low in available phosphorus and potassium. Crops respond poorly to fertilizer.

Most areas of this soil are cultivated or are in pasture. Few areas are wooded. This soil is poorly suited to corn, soybeans, and other cultivated crops or to small grains. This soil is moderately suited to hay and pasture and to trees. It is poorly suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of wind erosion. Conservation tillage helps to prevent excessive soil loss. Pasture and hay also control erosion. Terraces are difficult to construct and maintain. Wind erosion and blowing sand may damage new seedlings on this soil and on adjacent soils. Leaving crop residue on the surface helps to control wind erosion.

If this soil is used for pasture or hay, proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture and soil in reasonably good condition.

If this sandy soil is used for trees, seedling mortality is severe. Tree seeds, cuttings, and seedlings survive and grow if precipitation is normal and timely. Supplemental water may be needed. Competing vegetation should be controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IVs.

41C—Sparta loamy fine sand, 5 to 9 percent slopes. This moderately sloping, excessively drained soil is on convex ridge crests in the uplands and on stream benches. Individual areas are long and narrow and range from 2 to 10 acres.

Typically, the surface layer is very dark brown loamy fine sand about 7 inches thick. The subsurface layer is about 8 inches thick. It is very dark brown loamy fine sand in the upper part and very dark grayish brown loamy fine sand in the lower part. The subsoil extends to a depth of about 31 inches. The upper part of the subsoil is dark yellowish brown, friable loamy fine sand; and the lower part is yellowish brown, loose fine sand. The substratum is brown and yellowish brown, loose fine sand to a depth of about 60 inches.

Included with this soil in mapping are small areas of Dickinson soils, which are less droughty. Also included in mapping are areas of a soil that has a thin brown surface layer. Areas of this lighter colored soil are mostly in timber, but some are cultivated and eroded. This soil is low in organic matter and is very droughty. These soils make up less than 10 percent of the map unit.

This Sparta soil has low available water capacity and is droughty. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Surface runoff is slow. Tilth is good. This soil is generally acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 1 percent organic matter. The subsoil is very low in available phosphorus and potassium. Crops respond poorly to fertilizer.

Most areas of this soil are cultivated or are used for pasture. Few areas are wooded. This soil is poorly suited to corn, soybeans, and other cultivated crops or to small grains. This soil is moderately suited to hay and pasture and to trees. It is poorly suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage helps to prevent excessive soil loss. Pasture and hay also control erosion. Terraces are difficult to construct and maintain. Wind erosion is a hazard, and blowing sand may damage new seedlings on this soil and on adjacent soils. Leaving crop residue on the surface helps to control wind erosion.

If this soil is used for pasture or hay, proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture and soil in reasonably good condition.

If this sandy soil is used for trees, seedling mortality is severe. Tree seeds, cuttings, and seedlings survive and grow if precipitation is normal and timely. Supplemental water may be needed. Competing vegetation should be controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IVs.

55—Nicollet loam, 1 to 3 percent slopes. This gently sloping, somewhat poorly drained soil is in swales and

on knolls on gently undulating uplands. Slopes are typically short and slightly convex or concave. Individual areas are irregular in shape and range from 2 to 25 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is about 15 inches thick. It is black loam in the upper part and very dark grayish brown loam in the lower part. The subsoil is dark grayish brown and olive brown, friable loam to a depth of 29 inches. The substratum is light olive brown, calcareous loam to a depth of about 60 inches.

Included with this soil in mapping are some small areas of Okoboji soils in depressions that pond water. They make up about 2 to 5 percent of the map unit.

This Nicollet soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. Tilth is generally good. This soil is neutral or slightly acid and seldom needs lime. The surface layer contains about 5 percent organic matter. The subsoil is generally very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is moderately suited to sanitary facilities and building sites.

This soil is susceptible to slight wetness in rainy seasons. Subsurface drainage improves timeliness of tillage operations. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

62C3—Storden loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, well drained soil is on knobs, ridgetops, and side slopes. Slopes are short. Individual areas are circular to long and narrow and range from 2 to 10 acres.

Typically, the surface layer is mixed dark brown and brown loam about 8 inches thick. The substratum is yellowish brown, friable loam to a depth of about 60 inches.

Included with this soil in mapping are a few areas of less sloping, uneroded Storden soils that have a darker colored surface layer. Also included are a few knobby areas of Salida soils. Salida soils contain more sand and gravel than Storden soils and are more droughty. Included areas make up 5 to 10 percent of the map unit.

This Storden soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is generally good, but surface crusting is a problem after heavy rains. This soil is mildly or moderately alkaline and does not need lime. The surface layer contains less than 1 percent organic matter. This soil is very low in available phosphorus and potassium. An excess of lime in the surface layer adversely affects the response of crops to fertilizer and herbicides.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to hay and pasture. It is well suited to use for sanitary facilities and building sites.

If this soil is cultivated there is a hazard of further erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Contouring and terracing are difficult because of the undulating topography and short slopes, but most areas are suited to these practices. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

62D3—Storden loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, well drained soil is on knobs, ridgetops, and shoulders of hills. Slopes are short. Individual areas are circular to long and narrow and range from 2 to 10 acres.

Typically, the surface layer is mixed dark brown and brown, calcareous loam about 8 inches thick. The substratum is yellowish brown, friable, calcareous loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of Salida soils on the knobs. Salida soils contain more sand and gravel than Storden soils and are more droughty. They make up about 5 percent of the map unit.

The Storden soil has high available water capacity. Permeability is moderate. Surface runoff is rapid. Tilth is generally good, but surface crusting is a problem after heavy rains. This soil is mildly or moderately alkaline and does not need lime. The surface layer contains less than 1 percent organic matter. This soil is very low in available phosphorus and potassium. An excess of lime in the surface layer adversely affects the response of crops to fertilizer and herbicides.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to hay and pasture. It is moderately suited to use for sanitary facilities and building sites.

If this soil is cultivated there is a hazard of further erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Contouring and terracing are difficult because of the

undulating topography and short slopes, but most areas are suited to these practices. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

62E3—Storden loam, 14 to 18 percent slopes, severely eroded. This moderately steep, well drained soil is on knobs and shoulders of hills. Slopes are short. Individual areas are circular to long and narrow and range from 2 to 10 acres.

Typically, the surface layer is mixed dark brown and brown, calcareous loam about 8 inches thick. The substratum is yellowish brown, friable, calcareous loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of Salida soils on the knobs. Salida soils contain more sand and gravel than Storden soils and are more droughty. They make up about 5 to 10 percent of the map unit.

This Storden soil has high available water capacity. Permeability is moderate. Surface runoff is very rapid. Tilth is generally good, but surface crusting is a problem after heavy rains. This soil is mildly alkaline or moderately alkaline and does not need lime. The surface layer contains less than 1 percent organic matter. This soil is very low in available phosphorus and potassium. An excess of lime in the surface layer adversely affects the response of crops to fertilizer and herbicides.

Most areas of this soil are cultivated. This soil is poorly suited to cultivated crops, but it is associated with less sloping soils that are well suited to them. This soil is better suited to small grains and is moderately suited to hay and pasture. It is poorly suited to use for sanitary facilities and building sites.

If this soil is cultivated there is a hazard of further erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Contouring and terracing are difficult because of the undulating topography and short slopes, but most areas are suited to these practices. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IVe.

73C—Salida sandy loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, excessively drained soil is on knobs, ridges, escarpments, and side slopes on the uplands and on stream benches. Slopes are typically short. Individual areas are 2 to 5 acres in most places. On escarpments the individual areas are long and narrow and range from 2 to 40 acres.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsoil is brown, very friable gravelly loamy sand to a depth of 16 inches. The substratum is yellowish brown gravelly coarse sand to a depth of about 60 inches.

This Salida soil has very low available water capacity. Permeability is very rapid. Surface runoff is slow. Tilth is a problem in places because of the gravel. This soil is calcareous and mildly alkaline at shallow depths and does not need lime. The surface layer contains about 1 percent organic matter. The subsoil is very low in available phosphorus and potassium. Crops respond poorly to fertilizer.

Most areas of this soil are in pasture or are cultivated. This soil is poorly suited to corn, soybeans, and other cultivated crops and to small grains. Some areas are associated with soils that are well suited to crops. Some of these areas are cropped with those soils, and some are left in forage grasses for wildlife habitat or for grazing after harvest. This soil is moderately suited to hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and well suited to use for building sites. This soil is one of the better sources of gravel in the county.

Drought, erosion, and very low fertility limit crop production. Pasture and hay help to control erosion. Conservation tillage, winter cover crops, and grassed waterways also help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only very low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IVs.

73E—Salida sandy loam, 9 to 18 percent slopes. This strongly sloping and moderately steep, excessively drained soil is on knobs, escarpments, and side slopes on the uplands and on stream benches. Slopes are typically short. Individual areas are long and narrow and are 2 to 20 acres.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsoil is brown, very friable gravelly loamy sand to a depth of 16 inches. The substratum is yellowish brown gravelly coarse sand to a depth of 60 inches.

This Salida soil has very low available water capacity. Permeablity is very rapid. Surface runoff is slow. Tilth is a problem in places because of the gravel. This soil is

calcareous and mildly alkaline at shallow depths and does not need lime. The surface layer contains about 1 percent organic matter. The subsoil is very low in available phosphorus and potassium. Crops respond poorly to fertilizer.

Most areas of this soil are used for pasture or wildlife habitat. This soil is generally unsuitable for cultivated crops. It is moderately suited to hay and pasture and to trees. It is poorly suited to use for sanitary facilities and moderately suited to use for building sites. This soil is one of the better sources of gravel in the county. Hay and pasture and wildlife habitat are the best uses for this soil.

Drought, erosion, and very low fertility limit crop production. If not overgrazed, pasture or hay controls erosion.

Pasture can easily be overstocked since the soil has only very low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass VIs.

83—Kenyon loam, 0 to 2 percent slopes. This nearly level, well drained soil is on benchlike positions low in the uplands. In many places limestone bedrock is about 5 to 20 feet below the surface. Individual areas range from 2 to 40 acres in size.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black and dark brown loam about 14 inches thick. The subsoil extends to a depth of 52 inches. The upper part of the subsoil is brown, friable loam; the middle part is yellowish brown and light olive brown, friable loam; and the lower part is light olive brown, firm loam. The substratum is light olive brown loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of Rockton, Saude, and Waukee soils, which are more droughty. They make up about 5 percent of the map unit.

This Kenyon soil has high available water capacity. Permeability is moderate. Surface runoff is slow. Tilth is good. This soil is generally acid in the plow layer if it has not been limed in the last 5 years. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture, to trees, and to use for sanitary facilities and building sites.

This soil is subject to slight wind erosion if large areas are cultivated. Conservation tillage and winter cover crops help to prevent soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

83B—Kenyon loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on long, smooth, slightly convex ridge crests and side slopes in the uplands. Individual areas range from 2 acres to more than 100 acres in size.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black loam in the upper part and dark brown loam in the lower part and is about 13 inches thick. The subsoil is about 25 inches thick. The upper part of the subsoil is brown, friable loam; and the lower part is dark yellowish brown, mottled, firm loam. The substratum is yellowish brown, mottled, calcareous loam to a depth of 60 inches.

Included with this soil in mapping on side slopes are small areas of Cerlin soils, which have dense gray clay below a depth of 20 to 36 inches. These soils produce seepage during wet periods. Also included are small areas of wet Floyd soils along some waterways. Included areas make up less than 5 percent of the map unit.

This Kenyon soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is typically good. This soil is typically acid in the plow layer if it has not been limed in the last five years. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is moderately suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Pasture and hay also control erosion. The uniform slopes of this soil are well suited to contour cultivation and terracing. These practices slow movement of surface water and let more of it soak into the soil. This extra water complicates drainage, especially in wet years. A combination of terraces and subsurface drainage may be needed. Exposure of the subsoil in terraces should be minimized because the subsoil has low fertility and unfavorable tillage characteristics. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

83C2—Kenyon loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on rather short, convex side slopes in the uplands. This soil is below gently sloping Kenyon soils. Individual areas are regular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is dark brown and very dark grayish brown loam about 8 inches thick. Some brown subsoil material has been mixed into the surface layer. The subsoil is about 25 inches thick. The upper part of the subsoil is brown, friable loam; and the lower part is dark yellowish brown, mottled, firm loam. The substratum is yellowish brown, mottled, firm, calcareous loam to a depth of about 60 inches.

Included with this soil in mapping on side slopes are small areas of Cerlin soils, which have dense gray clay below a depth of 20 to 36 inches. These soils produce seepage during wet periods. Also included are small areas of wet Floyd soils along some waterways; these soils need subsurface drainage. Included areas make up less than 5 percent of the map unit.

This Kenyon soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is typically good. This soil is typically acid in the plow layer if it has not been limed in the last 5 years. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is moderately suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of further erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Pasture and hay also control erosion. The uniform slopes of this soil are well suited to contour cultivation and terracing. These practices slow movement of surface water and let more of it soak into the soil. This extra water complicates drainage, especially in wet years. A combination of terraces and subsurface drainage may be needed. The exposure of glacial till in the terraces should be minimized because the till has low fertility and unfavorable tillage characteristics. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

84—Clyde silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in drainageways and at the head of drainageways on the uplands. This soil is subject to flooding. Individual areas range from 3 to more than 100 acres.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is about 14 inches thick. It is black silty clay loam in the upper part and mottled dark grayish brown and very dark gray silty clay loam in the lower part. The subsoil extends to a depth of 48 inches. It is olive gray, friable silty clay loam in the upper part; yellowish brown, very friable sandy loam in the middle part; and gray and dark gray, firm clay in the lower part. The subtratum is yellowish brown and gray loam to a depth of about 72 inches.

Included with this soil in mapping are some small areas of Palms muck on toe slopes and in waterways that receive more concentrated seepage water. Also included along some waterways are small areas of Canisteo and Harps soils, which are calcareous. Included areas make up less than 10 percent of the map unit.

This Clyde soil has high available water capacity. Permeability is moderate, but the upper part of the subsoil is more permeable than the lower part and the substratum. This soil receives surface runoff. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is worked when wet. Shrink-swell potential is moderate in the surface layer and upper part of the subsoil. The surface layer is typically neutral or slightly acid and does not need lime. The surface layer contains about 8 percent organic matter. The subsoil is typically very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for most sanitary facilties and building sites.

If this soil is cultivated, there is a hazard of erosion in drainageways that receive runoff from large areas. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Subsurface drainage is needed for maximum production.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

95—Harps loam, 1 to 3 percent slopes. This very gently sloping, poorly drained, calcareous soil is on rims and low ridges around and between depressions in the uplands. Slopes are short. Individual areas are irregular in shape and range from 2 to 50 acres.

Typically, the surface layer is black, calcareous loam about 9 inches thick. The subsurface layer is very dark gray, friable, calcareous loam about 7 inches thick. The subsoil is friable, calcareous loam about 30 inches thick;

the upper part is light olive gray and dark gray; the middle part is olive gray and light olive brown; and the lower part is gray. The substratum is gray, calcareous loam to a depth of about 65 inches.

Included with this soil in mapping are small areas of Okoboji and Palms soils in very poorly drained depressions and Clarion and Storden soils on well drained humps. Also included are small areas of Salida soils on gravelly spots that are droughty. These areas make up less than 10 percent of the map unit.

This Harps soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. This soil typically has good tilth but becomes cloddy if tilled when wet. Shrink-swell potential is moderate. This soil is moderately alkaline and does not need lime. The surface layer contains about 5 percent organic matter. The subsoil is very low in available phosphorus and potassium. In many places, available iron is not sufficient for soybeans. An excess of lime adversely affects the response of crops to fertilizer and herbicides.

Most areas of this soil are cultivated. Most areas have been drained. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is moderately suited to hay and pasture. This soil is poorly suited to use for most sanitary facilities and building sites.

Wetness and excess lime limit crop production. Iron chlorosis and damage from herbicide carry-over are common in soybeans. Proper selection and use of soybean varieties, herbicides, and fertilizer minimize these problems. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

107—Webster silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in swales and waterways of glacial uplands. Individual areas are irregular in shape and range from 2 to 75 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 9 inches thick. The subsoil extends to a depth of about 37 inches. It is very dark gray, friable silty clay loam in the upper part; olive gray and dark gray, friable clay loam in the middle part; and olive gray, friable, calcareous silty clay loam in the lower part. The substratum is light olive gray, calcareous clay loam to a depth of 60 inches.

Included with this soil in mapping are small depressions of Okoboji soils that pond water and small areas of Harps and Canisteo soils, which have excess lime that adversely affects the response of crops to herbicides and fertilizer. Included areas make up less than 10 percent of the map unit.

This Webster soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if this soil is tilled when wet. Shrink-swell potential is high in the surface layer and subsoil. The surface layer is generally neutral and does not need lime. The surface layer contains about 7 percent organic matter. The subsoil is very low in available phosphorus and very low or low in available potassium.

Most areas of this soil are cultivated. It is well suited to corn, soybeans, and other cultivated crops and moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

Drainage is needed for optimum crop production. If large areas are plowed in fall, wind erosion is a hazard. Conservation tillage and crop residue left on the surface help to prevent wind erosion.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

135—Coland clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottomlands and in some upland drainageways. This soil is subject to flooding. Individual areas are long and narrow and range from 3 to 100 acres.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is also black clay loam about 34 inches thick. The substratum is olive gray loam in the upper part and very dark gray and dark gray loamy sand in the lower part to a depth of about 60 inches.

Included with this soil in mapping are some small areas of Palms muck on the seepy foot slopes of sandy escarpments. Also included are small areas of Hanlon soils adjacent to the stream meanders. In a few places near Rockwell and near the Shellrock and Winnebago Rivers, Tilfer and Faxon soils are included. The limestone bedrock in Faxon and Tilfer soils makes subsurface drainage difficult and costly. Included areas make up less than 10 percent of the map unit.

This Coland soil has high available water capacity. Permeability is moderate. This soil receives runoff and is commonly flooded. It has a seasonal high water table. The surface layer becomes cloddy and puddled if this soil is worked when wet. Shrink-swell potential is high in the surface layer. This soil is neutral or slightly acid and seldom needs lime. The surface layer contains about 7 percent organic matter. The substratum is typically low in

available phosphorus and very low in available potassium.

Most drained areas of this soil are cultivated. Undrained areas are commonly used for pasture. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for most sanitary facilities and building sites.

If this soil is cultivated, artificial drainage and flood protection are needed for optimum production.

If this soil is used for pasture, proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep pasture and soil in good condition.

This soil is in capability subclass IIw.

138—Clarion loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad upland ridges. Slopes are long and uniform. The areas have a developed dendritic drainage network with few or no depressions. Individual areas range from 5 acres to more than 100 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is brown, friable loam; and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown, calcareous loam to a depth of about 63 inches. Stratified lenses of sandy loam are common in the subsoil and substratum.

This Clarion soil has high available water capacity. Permeability is moderate. Surface runoff is slow. Tilth is good. The surface layer and subsoil are typically slightly acid or neutral and seldom need lime. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is well suited to use for most sanitary facilities and building sites.

This soil is subject to slight wind erosion if large areas are cultivated. Conservation tillage and winter cover crops reduce soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

138B—Clarion loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex knolls and ridgetops. Slopes are typically short. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is brown, friable loam; and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown, calcareous loam to a depth of about 63 inches.

Included with this soil in mapping are small areas of Storden soils, which are calcareous at the surface. Also included are sand or gravel spots that are droughty, wet spots that are poorly drained, and depressions that pond water. These areas make up less than 10 percent of the map unit.

This Clarion soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is good. The surface layer and subsoil are typically slightly acid or neutral. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is well suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage and winter cover crops help to prevent excessive soil loss. Pasture and hay also control erosion. Contouring and terracing are difficult because of the irregular shape of areas and the short slopes, but many areas are suitable for these practices. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

138C—Clarion loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on knolls, on convex side slopes that border streams, and on concave heads of upland drainageways. Slopes are typically short. Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 3 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is brown, friable loam; and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown, calcareous loam to a depth of about 63 inches.

Included with this soil in mapping are small areas of Terril soils on toe slopes of ridges and heads of

drainageways. These areas receive concentrated runoff from more sloping Clarion and Storden soils. Included soils make up less than 5 percent of the map unit.

This Clarion soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is good. The surface layer and subsoil are typically slightly acid or neutral. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are used for pasture. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. This soil is well suited to hay and pasture and to trees. In places this soil is associated with steeper soils that are poorly suited to these uses. This soil is well suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, grassed waterways, and winter cover crops help to prevent excessive soil loss. Pasture and hay also control erosion. Contouring and terracing are difficult because of the undulating topography and short slopes, but many areas are suitable for these practices. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

138C2—Clarion loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on knolls and on convex side slopes that border streams and upland drainageways. Slopes are typically short. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. Brown loam from the subsoil has been mixed into the surface layer. The subsoil is about 16 inches thick. The upper part is brown, friable loam; and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown, calcareous loam to a depth of about 63 inches.

Included with this soil in mapping are small areas of Storden soils on steeper convex side slopes that are severely eroded. Excess lime adversely affects the response of crops to fertilizer and herbicides. Also included are small areas of Salida soils, which are droughty, and small areas of Okoboji, Rolfe, and Webster soils in swales and depressions that need drainage. Included soils make up less than 10 percent of the map unit.

This Clarion soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is typically good. The surface layer and subsoil are typically slightly acid or neutral. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to hay and pasture. This soil is well suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of further erosion. Conservation tillage, grassed waterways, and winter cover crops help to prevent excessive soil loss. Pasture and hay also control erosion. Contouring and terracing are difficult because of the undulating topography and short slopes, but most areas are suitable for these practices. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and increases water infiltration.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

138D2—Clarion loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes bordering stream valleys and upland drainageways and in hilly areas in other parts of the county. Slopes are typically short. Individual areas are often irregular in shape and range from 3 to 25 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. Brown loam from the subsoil has been mixed into the surface layer. The subsoil is dark brown to yellowish brown, friable loam about 15 inches thick. The substratum is light olive brown, calcareous loam to a depth of about 63 inches.

Included with this soil in mapping are a few small areas of Storden soils on the more sloping convex side slopes that are severely eroded. Excess lime adversely affects the response of crops to fertilizer and herbicides. Also included are small areas of Salida soils, which are droughty, and small areas of Okoboji, Rolfe, and Webster soils in swales and depressions that need drainage. Included soils make up less than 10 percent of the map unit.

This Clarion soil has high available water capacity. Permeability is moderate. Surface runoff is rapid. Tilth is good. The surface layer and subsoil are typically slightly acid or neutral. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to grasses and legumes for hay and pasture. This soil is moderately suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of further erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Pasture and hay also control erosion. Contouring and terracing are difficult because of the undulating topography and short slopes, but most areas are suitable for these practices. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and increases water infiltration.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

151—Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is mostly on low stream benches. Some areas are in the uplands. Individual areas range from 2 acres to more than 100 acres in size.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 10 inches thick. The subsoil is olive gray loam to a depth of 28 inches. The substratum is gray and grayish brown sand and gravelly coarse sand to a depth of about 60 inches.

Included with this soil in mapping are some areas of soils that have a dominantly fine sand substratum. Placement and stability of subsurface drainage lines are problems in these areas because of loose, water-bearing fine sand. Most of these areas are along the wind-deposited sand ridges in Dougherty Township.

This Marshan soil has low or moderate available water capacity. Permeability is moderate in the subsoil and rapid in the gravelly substratum. Surface runoff is slow. This soil has a seasonal high water table. This soil typically has good tilth when adequately drained but becomes cloddy if tilled when wet. The surface layer is neutral and seldom needs liming. The plow layer contains about 6 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Many areas of this soil are drained and cultivated. If properly drained, this soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and poorly suited to commercial wood production. This soil is poorly suited to use for most kinds of sanitary facilities and building sites. Shallow wells can be dug on the stream benches.

Drainage is needed for optimum crop production; however, the loose, water-bearing sands cause problems in placement and stability of the subsurface drainage lines. Returning crop residue to the soil or regularly adding organic material improves fertility and helps to maintain good tilth.

If this soil is used for hay and pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

152—Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is mostly on low stream benches. Some areas are in the uplands. Individual areas are regular in shape and range from 2 acres to more than 100 acres in size.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 12 inches thick. The subsoil is about 15 inches thick. The upper part of the subsoil is grayish brown and olive gray, friable loam; and the lower part is olive gray, friable loam. The substratum is gray and grayish brown sand and gravelly coarse sand to a depth of about 60 inches.

This Marshan soil has moderate available water capacity. Permeability is moderate in the subsoil and rapid in the substratum. Surface runoff is slow. This soil has a seasonal high water table. This soil typically has good tilth if adequately drained but becomes cloddy if tilled when wet. The surface layer is neutral. This soil seldom needs liming. The plow layer contains about 6 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Many areas of this soil are drained and cultivated. If properly drained, this soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and poorly suited to commercial wood production. This soil is poorly suited to use for most kinds of sanitary facilities and building sites. Shallow wells can be dug on the stream benches.

Drainage is needed for optimum crop production; however, the loose, water-bearing sands cause problems in placement and stability of subsurface drainage lines. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

153—Shandep clay loam, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in depressions on stream benches and outwash plains. This soil is subject to flooding. Individual areas are generally long and narrow and range from 2 to 35 acres in size.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black clay loam

about 21 inches thick. The subsoil extends to a depth of 45 inches. The upper part of the subsoil is olive gray, friable loam with mottles; and the lower part is olive gray sandy loam. The substratum is gray loamy coarse sand to a depth of about 60 inches.

Included with this soil in mapping on slightly higher lying benches are some small areas of Harcot and Talcot soils. The surface layer of these soils has an excess of lime, which adversely affects the response of crops to fertilizer and herbicides. Included areas make up about 5 percent of the map unit.

This Shandep soil has moderate or high available water capacity. Permeability is moderate in the subsoil and rapid in the sandy substratum. This soil has a seasonal high water table and is ponded or flooded during wet periods. This soil frequently is ponded in spring. The surface layer becomes cloddy and puddled if the soil is tilled when wet. Shrink-swell potential is moderate. This soil is slightly acid or neutral and seldom needs lime. The surface layer contains about 7 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Artificially drained areas of this soil are generally cultivated. Undrained areas are used for wildlife habitat or pasture. If drained, this soil is moderately suited to corn, soybeans, and other cultivated crops; to small grains; and to grasses and legumes for hay and pasture. Undrained areas are well suited to wetland wildlife habitat. This soil is poorly suited to use for sanitary facilities and building sites.

Flooding and ponding limit crop production. Surface water intakes help to prevent damage to crops by ponding and flooding.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Many legumes are winter-killed or drown in spring. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

169B—Clarion loam, 2 to 5 percent long slopes. This gently sloping, well drained soil is on broad upland ridges. Slopes are long and uniform. The areas have a well developed dendritic drainage network with no depressions. Individual areas range from 5 acres to more than 100 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is brown, friable loam; and the lower part is dark yellowish brown, friable loam. The substratum is yellowish brown to light olive brown, calcareous loam to a depth of about 63 inches.

This Clarion soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is good. The surface layer and subsoil are typically slightly acid or neutral. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is well suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage and winter cover crops help to prevent excessive soil loss. Pasture and hay also control erosion. The long, uniform slopes are well suited to contour cultivation and terraces. The large areas of this soil and long, uniform slopes allow more specialized management and higher yields than are possible on Clarion soils that have short slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

171—Bassett loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on low uplands adjacent to bedrock terraces and stream channels. Individual areas range from 2 to 20 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is brown loam about 4 inches thick. The subsoil is about 52 inches thick. The upper part of the subsoil is brown, friable clay loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown, firm loam with grayish brown and strong brown mottles. The substratum is pale brown, calcareous loam to a depth of about 70 inches. Limestone bedrock is typically at a depth of 6 to 20 feet.

Included with this soil in mapping are small areas of soils that have dense gray clay below a depth of about 20 to 36 inches. These soils produce seepage. Also included are small areas of somewhat poorly drained Floyd and Schley soils. Included areas make up less than 10 percent of the map unit.

This Bassett soil has high available water capacity. Permeability is moderate. Surface runoff is slow. Tilth is good. This soil is typically acid in the plow layer if it has not been limed during the past 5 years. The subsoil ranges from medium acid to very strongly acid. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and

to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is well suited to use for most sanitary facilities and building sites.

This soil is subject to slight wind erosion if large areas are cultivated. Conservation tillage and winter cover crops help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability class I.

171B—Bassett loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on long, slightly convex crests and sides of ridges in the uplands. Individual areas range from 2 to 30 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsoil is about 50 inches thick. The upper part of the subsoil is brown, friable clay loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum is pale brown, calcareous loam to a depth of about 70 inches. In places a brown subsurface layer underlies the surface layer. In some places this soil has dense, gray clay below a depth of about 20 to 36 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Floyd and Schley soils along some of the waterways. These areas make up less than 5 percent of the map unit.

This Bassett soil has high available water capacity. Permeability is moderate. Surface runoff is medium. This soil has good tilth. The surface layer is typically medium acid to neutral. The plow layer is typically acid if the soil has not been limed within the last 5 years. The subsoil ranges from medium acid to very strongly acid. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is well suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Pasture and hay also control erosion. The uniform slopes of this soil are well suited to contour cultivation and terracing. These practices slow the movement of surface water and let more of it soak into the soil. This extra water complicates drainage, especially in wet years. A combination of terraces and subsurface drainage may be needed. The exposure of the subsoil in terraces should be minimized because the subsoil has low fertility and unfavorable tillage characteristics. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

171C2—Bassett loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, convex side slopes in the uplands. This soil is below gently sloping Bassett soils. Individual areas range from 2 to 15 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. Brown loam from the subsoil has been mixed into the surface layer. The subsoil is about 40 inches thick. It is brown, friable clay loam in the upper part; yellowish brown, firm loam in the middle part; and yellowish brown, mottled, firm loam in the lower part. The substratum is pale brown, calcareous loam to a depth of about 70 inches.

Included with this soil in mapping are small areas of soils that have dense gray clay below a depth of about 20 to 36 inches. These soils produce seepage during wet periods. Also included are small areas of Floyd and Schley soils along some of the waterways. Included areas make up less than 10 percent of the map unit.

This Bassett soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is good. The surface layer is typically medium acid to neutral. The plow layer is typically acid if the soil has not been limed within the last 5 years. The subsoil is medium acid to very strongly acid. The surface layer contains about 2 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to hay and pasture and to trees. This soil is moderately suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of further erosion. Conservation tillage, terraces, winter cover

crops, and grassed waterways help to prevent soil loss. Pasture and hay also control erosion. The uniform slopes are well suited to contour cultivation and terraces. These practices slow movement of surface water and let it soak into the soil. This extra water complicates drainage, especially in wet years. A combination of terraces and subsurface drainage may be needed. The exposure of subsoil in terraces should be minimized because the subsoil has low fertility and unfavorable tillage characteristics. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

171D2—Bassett loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on short, convex side slopes in the uplands. This soil is below gently sloping and moderately sloping Bassett soils. Most areas of this soil are adjacent to and parallel the flood plains. Individual areas are typically elongated and range from 2 to 10 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. Brown subsoil material has been mixed into the surface layer. The subsoil is about 35 inches thick. The upper part of the subsoil is brown, friable loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum is pale brown, calcareous loam to a depth of about 70 inches.

Included with this soil in mapping are small areas of soils that have dense gray clay below a depth of about 20 to 36 inches. These soils produce seepage during wet periods. Also included are some areas of a soil that has a very dark brown or very dark grayish brown loam surface layer 6 to 10 inches thick and a brown loam subsurface layer about 3 to 6 inches thick; these areas are used for timber and uncultivated pasture. Included areas make up less than 10 percent of the map unit.

This Bassett soil has high available water capacity. Permeability is moderate. Surface runoff is medium. This soil has good tilth. The surface layer typically is medium acid to neutral. The plow layer is typically acid if the soil has not been limed in the last 5 years. The subsoil ranges from slightly to very strongly acid. The surface layer contains about 2 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to hay and pasture and to trees. This soil is moderately suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of further erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Pasture and hay also help to control erosion. The uniform slopes of this soil are well suited to contour cultivation and terraces. These practices slow the movement of surface water and let more of it soak into the soil. This extra water complicates drainage, especially in wet years. A combination of terraces and subsurface drainage may be needed. The exposure of the subsoil in terraces should be minimized because the subsoil has low fertility and unfavorable tillage characteristics. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

171F—Bassett loam, 14 to 25 percent slopes. This moderately steep and steep, moderately well drained soil is on short convex side slopes. In most places this soil is below less sloping areas of Bassett and Kenyon soils. In most places areas are adjacent to and parallel flood plains and are along small streams and waterways that drain onto the flood plains. Individual areas are typically elongated and some extend for 3/4 mile or more along the flood plains. They range from 2 to 50 acres.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. The subsurface layer is brown loam about 3 inches thick. The subsoil is about 40 inches thick. The upper part of the subsoil is brown, friable loam; the middle part is yellowish brown, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum is pale brown, calcareous loam to a depth of about 70 inches.

Included with this soil in mapping are small areas of soils that have dense, gray clay below a depth of about 20 to 36 inches. These soils produce seepage. These soils make up about 2 to 5 percent of the map unit.

This Bassett soil has high available water capacity. Permeability is moderate. Surface runoff is rapid. Tilth is good. The surface layer typically is medium acid to neutral. Reaction ranges from medium acid to very strongly acid in the subsurface layer and the upper part of the subsoil and from slightly acid to medium acid in

the lower part of the subsoil. The surface layer contains about 2 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are in trees and grass. This soil is well suited to grasses and legumes for hay and pasture and to trees. It is generally unsuitable for cultivated crops because of the erosion hazard and the danger of operating farm machinery in the steeper areas. It is poorly suited to use for sanitary facilities and building sites.

Pasture and hay help to control erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling. A plant cover should be maintained to reduce the erosion hazard. Special equipment may be needed because of the moderately steep and steep slopes.

This soil is in capability subclass VIe.

173—Hoopeston fine sandy loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on low convex knolls and concave foot slopes of sandy ridges on the uplands and on stream benches. Slopes are typically short. Individual areas range from 3 to 50 acres.

Typically, the surface layer is black fine sandy loam about 9 inches thick. The subsurface layer is about 14 inches thick and is black fine sandy loam in the upper part and very dark brown fine sandy loam in the lower part. The subsoil is dark grayish brown, very friable fine sandy loam 12 inches thick. The substratum is grayish brown loamy sand to a depth of about 60 inches. In some places the surface layer is 6 inches thick.

Included with this soil in mapping are some areas on the benches where the substratum is gravelly below a depth of 30 to 40 inches. These areas are droughty. In some places near the Winnebago River limestone bedrock is below a depth of about 3 to 6 feet. In other places on the uplands glacial till is below a depth of about 40 to 60 inches. These areas are more affected by wetness. Included soils make up less than 10 percent of the map unit.

This Hoopeston soil has moderate available water capacity. Permeability is moderately rapid. Surface runoff is slow. This soil has a seasonal high water table. Tilth is good. This soil is generally acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is generally very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for most sanitary facilities and building sites.

If this soil is cultivated, there is a slight hazard of wind and water erosion. Minimum tillage and winter cover crops help to prevent excessive soil loss. Pasture and hay also control erosion. This soil is slightly droughty in dry periods and wet during wet periods. Seepage is common on foot slopes of sandy ridges. Placement of subsurface drainage lines is difficult in places because of the loose, water-bearing sands. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and increases water infiltration.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIs.

174—Bolan loam, 0 to 2 percent slopes. This nearly level, well drained soil is on convex sides of uplands and stream benches. This soil is mostly on low mounds slightly higher than associated soils. Individual areas range from 2 to 15 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is dark brown loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is dark brown, friable loam; and the lower part is dark yellowish brown, friable fine and very fine sandy loam. The substratum is dark yellowish brown loamy fine sand to a depth of about 60 inches.

Included with this soil in mapping in the uplands are some small areas of Dickinson soils. These areas are more droughty and are subject to wind erosion. Also included in the uplands are small areas of Cerlin and Kenyon soils. These soils have high available water capacity and may have a perched high water table during wet periods. Included soils make up less than 10 percent of the map unit.

This Bolan soil has moderate available water capacity. Permeability is moderate. Surface runoff is slow. Tilth typically is good. This soil typically is acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is moderately suited to use for most sanitary facilities and building sites.

If this soil is cultivated, it is susceptible to wind erosion in spring. Conservation tillage and winter cover crops

help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

174B—Bolan loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex side slopes on uplands and stream benches. This soil is mostly in low moundlike areas slightly higher than associated soils. Individual areas range from 2 to 30 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is dark brown, friable loam; and the lower part is dark yellowish brown, very friable fine sandy loam. The substratum is dark yellowish brown loamy fine sand to a depth of about 60 inches.

Included with this soil in mapping are some small areas of Dickinson soils. These areas are more droughty than Bolan soils and are subject to wind erosion. Also included are small areas of Cerlin and Kenyon soils. These soils have high available water capacity and may have a perched water table during wet periods. Included soils make up less than 10 percent of the map unit.

This Bolan soil has moderate available water capacity. Permeability is moderate. Surface runoff is medium. Tilth typically is good. This soil is typically acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is moderately suited to use for most sanitary facilities and building sites.

If this soil is cultivated, it is susceptible to wind and water erosion. Conservation tillage and winter cover crops help to prevent excessive soil loss. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

175—Dickinson fine sandy loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is in slightly convex areas on stream benches and uplands. Individual areas are 2 to 15 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 9 inches thick. The subsurface layer is dark brown fine sandy loam about 4 inches thick. The subsoil is about 26 inches thick. The upper part of the subsoil is brown, friable, fine sandy loam; and the lower part is dark yellowish brown, friable loamy fine sand. The substratum is yellowish brown sand to a depth of about 60 inches.

Included with this soil in mapping in slightly lower areas are a few small areas of Hoopeston soils, which need drainage. Also included on the more sloping convex areas are small areas of Sparta soils, which are more droughty. Included areas make up less than 5 percent of the map unit.

This Dickinson soil has low available water capacity and is droughty in some years. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Runoff is slow. Tilth is good. This soil is generally acid in the plow layer if it has not been limed during the past 5 years. The plow layer contains about 2 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. It is moderately suited to cultivated crops, hay and pasture, and trees. It is poorly suited to use for most sanitary facilities and well suited to use for building sites.

If this soil is cultivated, it is subject to slight wind erosion. Conservation tillage and winter cover crops help to prevent soil loss. Cultivating after heavy rains helps to prevent damage to young plants from blowing sand grains. Returning crop residue to the soil or regularly adding other organic material improves fertility.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIs.

175B—Dickinson fine sandy loam, 2 to 5 percent slopes. This gently sloping, somewhat excessively drained soil is on convex mounds and dunes on stream benches and uplands. Individual areas are 2 to 25 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 9 inches thick. The subsurface layer is dark brown fine sandy loam about 4 inches thick. The subsoil is about 26 inches thick. The upper part of the subsoil is brown, friable fine sandy loam; and the lower part is dark yellowish brown, friable loamy fine sand. The substratum is yellowish brown sand to a depth of about 60 inches.

Included with this soil in mapping in slightly concave areas are a few small areas of somewhat poorly drained Hoopeston soils, which need drainage. Also included on convex mounds are small areas of excessively drained Sparta soils, which are droughty. Included areas make up less than 10 percent of the map unit.

This Dickinson soil has low available water capacity. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Runoff is medium. Tilth is good. This soil is generally acid in the plow layer if it has not been limed during the past 5 years. The plow layer contains about 2 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to cultivated crops, hay and pasture, and trees. It is poorly suited to use for most sanitary facilities and well suited to use for building sites.

If this soil is cultivated, it is subject to wind erosion. Conservation tillage and winter cover crops help to prevent soil loss. Cultivating after heavy rains helps to prevent damage to young crops from blowing sand grains. Returning crop residue to the soil or regularly adding other organic material improves fertility.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

177—Saude loam, 0 to 2 percent slopes. This nearly level, well drained soil is mostly on stream benches. Some areas are in the uplands. Individual areas range from 2 acres to more than 100 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark brown loam about 7 inches thick. The subsoil is about 10 inches thick. The upper part of the subsoil is dark yellowish brown, friable loam; and the lower part is dark yellowish brown, very friable sandy loam. The substratum is dark yellowish brown loamy sand and gravelly coarse sand to a depth of about 72 inches.

Included with this soil in mapping on convex knolls are small areas of somewhat excessively drained Flagler soils. These areas make up 2 to 5 percent of the map unit.

This Saude soil has low available water capacity and is droughty in years of normal or below-normal rainfall. Permeability is moderate in the loamy subsoil and very rapid in the sandy substratum. Surface runoff is slow. This soil generally has good tilth. Reaction is typically medium acid to neutral in the surface layer and medium acid or strongly acid in the subsoil. The plow layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and well suited to use for building sites.

If this soil is cultivated, returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

177B—Saude loam, 2 to 5 percent slopes. This gently sloping, well drained soil is mostly on stream benches. Some areas are in the uplands. Individual areas range from 2 to about 50 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark brown loam about 5 inches thick. The subsoil is about 10 inches thick. The upper part of the subsoil is dark yellowish brown, friable loam; and the lower part is dark yellowish brown, very friable sandy loam. The substratum is dark yellowish brown loamy sand and gravelly coarse sand to a depth of about 72 inches.

Included with this soil in mapping on convex knolls are small areas of somewhat excessively drained Dickinson and Flagler soils. These areas make up about 5 percent of the map unit.

This Saude soil has low available water capacity and is slightly droughty in years of normal or below-normal rainfall. Permeability is moderate in the loamy surface layer and very rapid in the sandy substratum. Surface runoff is medium. This soil generally has good tilth. Reaction is typically medium acid to neutral in the surface layer and medium acid or strongly acid in the subsoil. The plow layer is generally acid if the soil has not been limed within the last 5 years. The plow layer contains about 3 percent organic matter. The subsoil is very low in available phosphorous and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and well suited to use for building sites.

If this soil is cultivated, there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Terrace cuts should be minimized to avoid exposing the sandy and gravelly material. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

177C—Saude loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is mostly on stream benches. Some areas are in the uplands. Individual areas are elongated in shape and range from 2 to about 10 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark

grayish brown loam 4 inches thick. The subsoil is about 9 inches thick. The upper part of the subsoil is dark yellowish brown, friable loam, and the lower part is dark yellowish brown, very friable sandy loam. The substratum is dark yellowish brown loamy sand and gravelly coarse sand to a depth of about 72 inches.

Included with this soil in mapping on convex knolls are small areas of somewhat excessively drained Dickinson and Flagler soils. These areas make up less than 10 percent of the map unit.

This Saude soil has low available water capacity and is droughty. Permeability is moderate in the loamy surface layer and very rapid in the sandy substratum. Surface runoff is medium. This soil generally has good tilth. Reaction is typically medium acid to neutral in the surface layer and medium acid or strongly acid in the subsoil. The plow layer typically is acid if the soil has not been limed in the last 5 years. The plow layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Many areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and moderately suited to use for building sites.

If this soil is cultivated, there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Terrace cuts should be minimized to avoid exposing the sandy and gravelly material. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only moderate water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

177C2—Saude loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping; well drained soil is mostly on stream benches. Some areas are in the uplands. Individual areas are elongated in shape and range from 2 to about 10 acres in size.

Typically, the surface layer is dark brown loam 8 inches thick. Dark yellowish brown loam from the subsoil has been mixed into the surface layer. The subsoil is about 9 inches thick. The upper part of the subsoil is dark yellowish brown, friable loam; and the lower part is dark yellowish brown, very friable sandy loam. The substratum is dark yellowish brown loamy sand and gravelly coarse sand to a depth of about 72 inches.

Included with this soil in mapping on convex knolls are small areas of somewhat excessively drained Dickinson and Flagler soils. These areas make up less than 10 percent of the map unit.

This Saude soil has low available water capacity and is droughty. Permeability is moderate in the loamy surface layer and very rapid in the sandy substratum. Surface runoff is medium. This soil generally has good tilth. Reaction is typically medium acid to neutral in the surface layer and medium acid or strongly acid in the subsoil. The plow layer typically is acid if the soil has not been limed in the last 5 years. The plow layer contains about 2 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Many areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and moderately suited to use for building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Terrace cuts should be minimized to avoid exposing the sandy and gravelly material. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

178—Waukee loam, 0 to 2 percent slopes. This nearly level, well drained soil is mostly on stream benches. Some areas are on the uplands. Individual areas range from 2 acres to more than 100 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is about 10 inches thick and is very dark brown loam in the upper part and dark brown loam in the lower part. The subsoil is brown and dark yellowish brown, friable loam to a depth of 34 inches. The substratum extends to a depth of about 72 inches and is dark yellowish brown and brown loamy coarse sand and coarse sand with some gravel. In places the surface layer is very dark grayish brown loam about 8 inches thick and the subsurface layer is absent.

This Waukee soil has moderate available water capacity and is slightly droughty in years of below-normal rainfall. Permeability is moderate in the loamy subsoil and very rapid in the sandy substratum. Surface runoff is slow. This soil has good tilth. Reaction in the plow layer ranges from neutral to medium acid depending on past liming practices. The subsoil is medium acid or strongly acid. The plow layer contains about 4 percent organic matter. The subsoil is very low in available phosphorous and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and well suited to use for building sites.

If this soil is cultivated, returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

178B—Waukee loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on slightly convex side slopes. Most areas of this soil are on stream benches, but some are on the uplands. Individual areas range from 3 to 20 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is about 8 inches thick and is very dark brown loam in the upper part and dark brown loam in the lower part. The subsoil is brown and dark yellowish brown, friable loam to a depth of 34 inches. The substratum extends to a depth of about 72 inches and is dark yellowish brown and brown loamy coarse sand and coarse sand with some gravel. In places the surface layer is very dark grayish brown loam about 8 inches thick and the subsurface layer is absent.

This Waukee soil has moderate available water capacity and is droughty in years of below-normal rainfall. Permeability is moderate in the loamy subsoil and very rapid in the substratum. Surface runoff is medium. This soil has good tilth. Reaction in the plow layer ranges from neutral to medium acid depending on past liming practices. The subsoil is medium acid or strongly acid. The plow layer contains 4 percent organic matter. The subsoil is very low in available phosphorous and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and well suited to use for building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Pasture and hay also control erosion. Terrace cuts should be minimized to avoid exposing the sandy and gravelly material. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

184—Klinger silty clay loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on slightly convex crests and sides of ridges in the uplands. Individual areas are regular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 7 inches thick. The subsoil is about 31 inches thick. The upper part of the subsoil is dark grayish brown, friable silty clay loam; the middle part is mottled dark yellowish brown and dark grayish brown, friable silty clay loam; and the lower part is yellowish brown, mottled, firm loam. The substratum is a yellowish brown, mottled loam to a depth of about 76 inches. In places, the surface layer is very dark grayish brown silty clay loam about 8 inches thick and the subsurface layer is dark grayish brown silty clay loam about 4 inches thick.

Included with this soil in mapping are a few small areas of poorly drained Maxfield soils in the drainageways.

This Klinger soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. Tilth is typically good. The surface layer is typically neutral to medium acid. The plow layer is typically acid if the soil has not been limed in the past 5 years. The subsoil is medium acid or slightly acid. The surface layer contains about 5 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is moderately suited to use for most sanitary facilities and building sites.

Wetness limits crop production, especially during the rainy part of the year. Subsurface drainage may improve timeliness of field operations. If used for crops, the more sloping areas of this soil are subject to slight erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

188—Kensett loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on low convex ridges and concave heads of drainageways on stream benches and uplands. Individual areas range from 2 to 15 acres.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is black loam about 8

inches thick. The subsoil extends to a depth of 28 inches. The upper part of the subsoil is dark grayish brown, mottled, friable loam; the middle part is light olive brown, mottled, friable loam; and the lower part is yellowish brown, loose gravelly loamy sand. Hard, fractured limestone bedrock is at a depth of 28 inches. In some places depth to limestone is 40 to 50 inches.

This Kensett soil has low or moderate available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. Tilth is generally good. Reaction is slightly acid or neutral in the surface layer and subsoil. Shrink-swell potential is moderate in the upper part of the soil. The root zone is limited by the limestone. The surface layer contains about 5 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated or are used for pasture. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. In places, however, this soil is associated with shallower soils that are poorly suited to these uses. This soil is poorly suited to use for most sanitary facilities and building sites.

Depth to bedrock and wetness limit crop production. Subsurface drainage improves timeliness of field operations in some years. Installation of subsurface lines and open ditches is difficult because of the limestone substratum.

Pasture can easily be overstocked since the soil has only low or moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

198B—Floyd loam, 1 to 4 percent slopes. This very gently sloping and gently sloping, somewhat poorly drained soil is on concave foot slopes adjacent to upland drainageways. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black clay loam about 13 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is olive brown, mottled, friable clay loam; the middle part is yellowish brown, friable sandy clay loam; and the lower part is mottled yellowish brown and grayish brown, firm sandy clay loam. The substratum is mottled light brownish gray and strong brown loam to a depth of about 78 inches.

Included with this soil in mapping are some small areas of poorly drained Clyde soils in the drainageways. Also included are some small areas of Cerlin soils, which have dense gray clay below a depth of 20 to 36 inches. These soils produce seepage during wet periods. Included areas make up less than 10 percent of the map unit.

This Floyd soil has high available water capacity. Permeability is moderate. Surface runoff is slow, and the soil receives some runoff from higher lying soils. This soil has a seasonal high water table. Tilth is typically good. Reaction is slightly acid or neutral in the surface layer and subsoil. The surface layer contains about 6 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for most sanitary facilities and building sites.

Wetness limits crop production, especially in spring and during rainy seasons. The wetness is caused in part by seepage. A drainage system that intercepts laterally moving water is the most successful sort. Some areas are subject to slight erosion when cropped. Returning crop residue to the soil or regularly adding other organic matter improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

201B—Coland-Terril complex, 1 to 4 percent slopes. This complex consists of very gently sloping and gently sloping, moderately well drained and poorly drained soils in narrow drainageways on the uplands. Individual areas range from 5 to 35 acres in size. This complex is about 65 percent Coland soil and 35 percent Terril soil. The Coland soil is adjacent to the streams and drainageways, and the Terril soil is on the side slopes. The Coland soil is subject to flooding. Areas of the two soils are narrow and are so small that it was not practical to separate them in mapping.

Typically, the Coland soil has a surface layer of black clay loam about 8 inches thick. The subsurface layer is black clay loam about 34 inches thick. The substratum extends to a depth of about 60 inches and is olive gray loam in the upper part and very dark gray and dark gray loamy sand in the lower part.

Typically, the Terril soil has a surface layer of black loam about 13 inches thick. The subsurface layer is about 17 inches thick and is black loam in the upper part and very dark brown clay loam in the lower part. The subsoil extends to a depth of 48 inches. It is dark brown, friable clay loam in the upper part and dark yellowish brown, friable sandy clay loam in the lower part. The substratum is yellowish brown, friable loam to a depth of about 74 inches.

These Coland and Terril soils have high available water capacity. Permeability is moderate. These soils receive concentrated runoff from large upland areas. The Coland soil has a seasonal high water table and is flooded after heavy rains. The surface layer of both soils becomes cloddy and puddled if the soil is tilled when

wet. These soils are neutral or slightly acid and seldom need lime. The Coland soil contains about 7 percent organic matter in the surface layer, and the Terril soil contains about 5 percent. The subsoil is very low in available phosphorus and potassium.

Most areas of these soils remain in native grass and are used for pasture. These soils are moderately suited to pasture. They are poorly suited to cultivated crops because of flooding. Small streams or drainageways that cannot be crossed with tillage implements flow through the center of most areas and limit use to pasture or wildlife habitat. The Coland soil is poorly suited to use for sanitary facilities and building sites; the Terril soil is well suited to these uses.

If these soils are used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This complex is in capability subclass IIIw.

213—Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes. This nearly level, well drained soil is on broad ridges on the uplands and on stream benches. This soil is above more sloping Rockton soils. Individual areas range from 2 to 100 acres.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is brown, friable clay loam; the middle part is brown, friable sandy clay loam; and the lower part is reddish brown, firm clay. Hard, level-bedded limestone bedrock is at a depth of about 34 inches. In places the depth to limestone is 40 to 60 inches.

This Rockton soil has moderate available water capacity and is slightly droughty in years of below normal rainfall. Permeability is moderate. Surface runoff is slow. This soil has good tilth. The root zone is limited by the limestone. The soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and moderately suited to building sites.

If this soil is cultivated, returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

213B—Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on crests and sides of ridges on the uplands and stream benches. Individual areas range from 2 to 60 acres.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is brown, friable clay loam; the middle part is brown, friable sandy clay loam; and the lower part is reddish brown, firm clay. Hard, level-bedded limestone bedrock is at a depth of 34 inches. In places, the depth to limestone is 40 to 60 inches.

Included with this soil in mapping on the side slopes are a few small eroded spots that have some brown clay loam from the subsoil mixed into the surface layer. These areas make up less than 5 percent of the map unit.

This Rockton soil has moderate available water capacity and is droughty in years of below-normal rainfall. Permeability is moderate. Surface runoff is medium. This soil has good tilth. The root zone is limited by the limestone. The soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and moderately suited to use for building sites.

If this soil is cultivated, there is a hazard of erosion. Conservation tillage, winter cover crops, terraces, and grassed waterways help to prevent soil loss. In some places terrace construction may be difficult because of the depth to limestone bedrock. Terrace cuts should be minimized to avoid exposing the limestone in the channel. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

214—Rockton loam, 20 to 30 inches to limestone, 0 to 2 percent slopes. This nearly level, well drained soil is in high areas on broad ridges on the uplands and on stream benches. This soil is above more sloping Rockton soils. Individual areas range from 2 to 100 acres.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark

grayish brown loam about 6 inches thick. The subsoil is about 15 inches thick. The upper part of the subsoil is brown, friable clay loam; the middle part is brown, friable sandy clay loam; and the lower part is brown, firm clay. Hard, level-bedded limestone bedrock is at a depth of about 28 inches. In places, the depth to limestone is less than 20 inches.

This Rockton soil has low available water capacity and is droughty in years of below-normal rainfall. Permeability is moderate. Surface runoff is slow. This soil has good tilth. The root zone is limited by the limestone. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and moderately suited to use for building sites.

If this soil is cultivated, returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

214B—Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on crests and sides of ridges on the uplands and on stream benches. Individual areas range from 2 to 60 acres.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 11 inches thick. The upper part of the subsoil is brown, friable clay loam; the middle part is brown, friable sandy clay loam; and the lower part is brown, firm clay. Hard, level-bedded limestone bedrock is at a depth of about 24 inches. In places, the depth to limestone is less than 20 inches.

Included with this soil in mapping on side slopes are small areas of limestone bedrock outcrops. These areas make up about 5 percent of the map unit.

This Rockton soil has low available water capacity and is droughty in years of normal or below-normal rainfall. Permeability is moderate. Surface runoff is medium. This soil has good tilth. The root zone is limited by the limestone. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and moderately suited to use for building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Terrace cuts should be minimized to avoid exposing the underlying limestone bedrock in the channel. In some places the bedrock will interfere with terrace construction. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

214C—Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes. This moderately sloping, well drained soil is on crests and sides of ridges on the uplands. In some areas this soil is above steep Sogn soils. Individual areas range from 2 to 20 acres in size.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is dark brown loam about 5 inches thick. The subsoil is about 11 inches thick. The upper part of the subsoil is brown, firm clay loam; and the lower part is brown, firm clay. Hard, level-bedded limestone bedrock is at a depth of about 23 inches.

Included with this soil in mapping on side slopes are small areas of limestone bedrock outcrops. Also included are small eroded areas where brown clay loam from the subsoil has been mixed into the surface layer. Included areas make up less than 10 percent of the map unit.

This Rockton soil has low available water capacity and is droughty in years of normal or below-normal rainfall. Permeability is moderate. Surface runoff in medium. This soil has good tilth. The root zone is limited by the limestone. The soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Many areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Terrace cuts should be minimized to avoid exposing the underlying limestone bedrock in the terrace channel. In some places the bedrock will interfere with terrace construction. Returning crop residue to the soil or

regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

216B—Ripon silt loam, 20 to 30 inches to limestone, 1 to 5 percent slopes. This very gently sloping and gently sloping, well drained soil is on upland ridge crests. Individual areas range from 5 to 40 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark brown silt loam about 6 inches thick. The subsoil typically extends to a depth of about 24 inches. It is dark yellowish brown, friable silty clay loam in the upper part and dark yellowish brown and strong brown clay loam in the lower part. Hard, level-bedded limestone bedrock is at a depth of about 24 inches.

This Ripon soil has low available water capacity. Permeability is moderate. Surface runoff is slow. Tilth is generally good. The root zone is limited by the limestone bedrock. The surface layer and subsoil are typically neutral or slightly acid. The plow layer contains about 4 percent organic matter. The subsoil is generally low in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and building sites because of the depth to limestone.

If this soil is cultivated there is a hazard of erosion. Conservation tillage and winter cover crops help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

217—Ripon silt loam, 30 to 40 inches to limestone, 0 to 2 percent slopes. This nearly level, well drained soil is on broad upland ridge crests. Individual areas are 2 to 100 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of 36 inches. It is brown and dark yellowish brown, friable silty clay loam in the upper part; dark yellowish brown, friable clay loam in the middle part; and strong brown, firm clay loam and silty clay in the lower part. Hard, level-bedded limestone bedrock is at a depth of about 36 inches. In some places, depth to limestone bedrock is 40 to 50 inches.

This Ripon soil has moderate available water capacity. Permeability is moderate. Surface runoff is slow. Tilth is generally good. The root zone is limited by the limestone bedrock. The surface layer and subsoil are typically neutral or slightly acid. The plow layer contains about 4 percent organic matter. The subsoil is generally low in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to sanitary facilities and building sites because of the depth to rock.

If large areas of this soil are cultivated, there is a hazard of wind erosion. Conservation tillage and winter cover crops help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability class I.

217B—Ripon silt loam, 30 to 40 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on upland ridge crests. Individual areas range from 5 to 40 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark brown silt loam about 6 inches thick. The subsoil extends to a depth of 36 inches. It is brown and dark yellowish brown, friable silty clay loam in the upper part and dark yellowish brown and strong brown, firm clay loam in the lower part. Hard, level-bedded limestone bedrock is at a depth of about 36 inches. In some places, depth to limestone bedrock is 40 to 50 inches.

This Ripon soil has moderate available water capacity. Permeability is moderate. Surface runoff is slow. Tilth is generally good. The root zone is limited by the limestone bedrock. The surface layer and subsoil are typically neutral or slightly acid. The plow layer contains about 4 percent organic matter. The subsoil is generally low in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to sanitary facilities and building sites because of the depth to rock.

If this soil is cultivated, there is a hazard of erosion. Conservation tillage and winter cover crops help to prevent excessive soil loss. Returning crop residue to

the soil or regularly adding other organic material improves the fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

221—Palms muck, 0 to 1 percent slopes. This level, very poorly drained soil is in depressions on the uplands, on stream benches, and on flood plains. This soil is subject to ponding. Individual areas range from 2 to 80 acres.

Typically, the surface layer is black sapric material about 8 inches thick. The subsurface layer is black sapric material about 28 inches thick. The substratum is gray and yellowish red, mottled loam to a depth of about 60 inches.

Included with this soil in mapping in the larger areas are some areas of Houghton soils, which have more than 51 inches of organic material. Subsurface drainage lines may settle and be difficult to maintain in these areas. These areas make up less than 10 percent of the map unit.

This Palms soil has very high available water capacity. Permeability is moderately rapid in the surface and subsurface layers and moderate in the substratum. Even if drained, this soil is ponded after heavy rains and spring thaws. It has a seasonal high water table. Tilth is good if the soil is adequately drained. This soil is neutral to moderately alkaline and does not need lime. Organic matter content of the surface layer is greater than 75 percent. The subsurface layer and substratum is very low in available phosphorus and potassium. Herbicides and fertilizer are less effective in calcareous areas.

If properly drained, this soil is moderately suited to corn, soybeans, and small grains. A few areas are well suited to specialty crops such as carrots, onions, and potatoes. This soil is poorly suited to hay and pasture or to trees. Undrained areas are well suited to wetland wildlife habitat. This soil is poorly suited to most kinds of sanitary facilities and building sites.

Because of the high water table and sidehill seepage, this soil needs artificial drainage for successful cultivation. Areas that have not been drained have a water table at or near the surface. If the soil is artificially drained, the organic matter settles. If subsurface drainage lines are placed in the organic material, shrinkage of the material alters their alignment, causing them to function improperly. Subsurface drains function better if they are placed in the underlying mineral material. In some areas, outlets are difficult to obtain. In many areas, surface intakes to subsurface lines or shallow ditches are needed to drain the soil and remove ponded water.

The tilth of the spongy surface layer is easily damaged by grazing livestock. Stocking or grazing should be restricted during wet periods. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

221B—Palms muck, 1 to 4 percent slopes. This very gently sloping and gently sloping, poorly drained soil is in seep areas on side slopes of uplands and stream benches. This soil is subject to ponding. Individual areas are long and narrow and range from 2 to 20 acres.

Typically, the surface layer is black sapric material about 8 inches thick. The subsurface layer is black sapric material about 22 inches thick. The substratum extends to a depth of about 60 inches and is gray loam with mottles of olive brown and yellowish red.

Included with this soil in mapping are small areas of Houghton soils, which have more than 51 inches of organic material. Subsurface drainage lines may settle and be difficult to maintain in these areas. These soils make up less than 10 percent of the map unit.

This Palms soil has very high available water capacity. Permeability is moderately rapid in the organic material and moderate in the substratum. This soil has a seasonal high water table. This soil is ponded after heavy rains. Tilth is good if the soil is adequately drained. This soil is neutral to moderately alkaline and does not need lime. Organic matter content of the surface layer is more than 20 percent. The subsoil is very low in available phosphorus and potassium. Calcareous areas reduce the effect of herbicides and fertilizer.

If properly drained, this soil is moderately suited to corn, soybeans, and small grains. Many areas do not have good subsurface drainage systems and are used for pasture. This soil is poorly suited to pasture and trees. Undrained areas are well suited to wetland wildlife habitat. This soil is poorly suited to use for most kinds of sanitary facilities and building sites.

Because of the high water table and sidehill seepage, this soil needs artificial drainage for successful cultivation. Areas that have not been drained have a water table at or near the surface. If the soil is artifically drained, the organic matter settles. If subsurface drainage lines are placed in the organic material, shrinkage of the material alters their alignment, causing them to function improperly. Subsurface drains function better if they are placed in the underlying mineral material. In some areas, outlets are difficult to obtain. In many areas, surface intakes to subsurface lines or shallow ditches are needed to drain the soil and remove ponded water.

The tilth of the spongy surface layer is easily damaged by grazing livestock. Stocking or grazing should be restricted during wet periods. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

225—Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches and in upland alluvial areas. Slopes are typically slightly convex. Individual areas range from 2 acres to more than 60 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 8 inches thick. The subsoil extends to a depth of 28 inches. The upper part of the subsoil is dark grayish brown, friable loam; the middle part is grayish brown and light olive brown, friable loam; and the lower part is grayish brown, light olive brown, and light brownish gray, very friable sandy loam. The substratum is light olive brown and yellowish brown gravelly coarse sand to a depth of about 60 inches.

Included with this soil in mapping are a few small sandy areas of more droughty Dickinson and Flagler soils on low mounds. These areas make up less than 5 percent of the map unit.

This Lawler soil has low to moderate available water capacity and is droughty in years of below-normal rainfall. Permeability is moderate in the subsoil and rapid in the sandy substratum. This soil has a seasonal high water table. Surface runoff is slow. Tilth is generally good. This soil is generally acid in the surface layer if it has not been limed during the past 5 years. The surface layer contains about 5 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and building sites.

If this soil is cultivated, subsurface drainage improves timeliness of field operations during extended wet periods. Placement of drainage lines is difficult in some places because of the loose, water-bearing sands. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low to moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

226—Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches and in upland alluvial areas. Slopes are typically slightly concave. Individual areas range from 2 to 50 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 12 inches thick. The subsoil typically extends to a depth of 36 inches. The upper part of the subsoil is dark grayish brown, friable loam; the middle part is grayish brown and light olive brown, friable loam; and the lower part is grayish brown and light brownish gray, friable loam. The substratum is light olive brown and yellowish brown gravelly coarse sand to a depth of about 60 inches. In some places, the depth to the sand and gravel substratum is 40 to 60 inches.

Included with this soil in mapping are small sandy areas of more droughty Dickinson and Flagler soils on low mounds. Also included in depressions and swales are small areas of Marshan soils, which need drainage. Included areas make up less than 10 percent of the map unit.

This Lawler soil has moderate available water capacity and is slightly droughty in years of below-normal rainfall. Permeability is moderate in the subsoil and rapid in the sandy substratum. This soil has a seasonal high water table. Some areas on lower parts of stream benches are subject to short floods. Surface runoff is slow. Tilth is generally good. This soil is generally acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 5 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and building sites.

If this soil is cultivated, subsurface drainage improves timeliness of field operations during extended wet periods. Placement of drainage lines is difficult in some places because of the loose, water-bearing sands. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

236B—Lester loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex knolls and ridgetops. Individual areas are irregular in shape and range from 2 to 25 acres. About 315 acres, mostly in Lincoln Township, has long, smooth slopes.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part of the subsoil is brown, friable clay loam; the middle part is dark yellowish brown, friable clay loam; and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown and yellowish brown loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of Okoboji and Webster soils in depressions and swales

that need drainage. Also included are some small areas of Kilkenny soils, which are higher in clay content. Included areas make up less than 5 percent of the map unit.

This Lester soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is good. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is medium in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. This soil is also well suited to grasses and legumes for hay and pasture and to trees. It is well suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage and winter cover crops help to prevent excessive soil loss. Contouring and terracing are difficult because of the undulating topography and short slopes, but many areas are suited to these practices. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction and excessive runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

236C—Lester loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on knolls on convex side slopes that border streams and on concave heads of upland drainageways. Slopes are typically short. Individual areas are irregular in shape and range from 2 to 15 acres.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part of the subsoil is brown, friable clay loam; the middle part is dark yellowish brown, friable clay loam; and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown and yellowish brown loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of Okoboji and Webster soils in depressions and swales that need drainage. These areas make up less than 5 percent of the map unit.

This Lester soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is good. This soil is generally acid if it has not been limed in the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is medium in available phosphorus and very low in available potassium.

Most areas of this soil are used for pasture or trees. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to hay and pasture and to trees. In places this soil is associated with steeper soils that are poorly suited to these uses. This soil is moderately suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, grassed waterways, and winter cover crops help to prevent excessive soil loss. Contouring and terracing are difficult because of the undulating topography and short slopes, but many areas are suitable for these practices. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction and excessive runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

236C2—Lester loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on knolls and on convex side slopes that border streams and upland drainageways. Slopes are typically short. Individual areas are irregular in shape and range from 2 to 5 acres.

Typically, the surface layer is mixed very dark grayish brown and brown loam about 8 inches thick. Plowing has mixed subsoil material into the surface layer. The subsoil is about 24 inches thick. The upper part of the subsoil is dark yellowish brown, friable clay loam; and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown and yellowish brown loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of Storden soils on steeper convex slopes that are severely eroded. Crops do not respond as well to fertilizer and herbicides on these soils. Also included are small areas of droughty Salida soils on knobs, and small areas of Okoboji, Rolfe, and Webster soils in swales and depressions that need drainage. Included areas make up less than 10 percent of the map unit.

This Lester soil has high available water capacity. Permeablity is moderate. Surface runoff is medium. Tilth is generally good. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The

surface layer contains about 2 percent organic matter. The subsoil is medium in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to hay and pasture and to trees. This soil is moderately suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of further erosion. Conservation tillage, grassed waterways, and winter cover crops help to prevent excessive soil loss. Contouring and terracing are difficult because of the undulating topography and short slopes, but most areas are suited to these practices. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and increases water infiltration.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction and excessive runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

236D2—Lester loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes bordering stream valleys and upland drainageways and in hilly areas in other parts of the county. The slopes are typically short. Individual areas are often irregular in shape and range from 2 to 25 acres.

Typically, the surface layer is mixed very dark grayish brown and brown loam about 8 inches thick. Plowing has mixed subsoil material into the surface layer. The subsoil is about 24 inches thick. The upper part of the subsoil is dark yellowish brown, friable clay loam; and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown and yellowish brown loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of Storden soils on steeper convex slopes that are severely eroded. Crops do not respond as well to fertilizer and herbicides on these soils. Also included on knobs are small areas of droughty Salida soils and of Kilkenny soils, which have more clay and require more power for tillage. Included areas make up less than 10 percent of the map unit.

This Lester soil has high available water capacity. Permeability is moderate. Surface runoff is rapid. Tilth is generally good. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 2 percent organic matter. The subsoil is medium in available phosphorus and very low in available potassium.

Most areas of this soil are used for pasture or are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to hay and pasture and to trees. This soil is moderately suited to use for most sanitary facilities and building sites.

If this soil is cultivated, there is a hazard of further erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Contouring and terracing are difficult because of the undulating topography and short slopes, but most areas are suitable for these practices. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases water infiltration.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction and excessive runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

236E2—Lester loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex side slopes bordering stream valleys and upland drainageways and in hilly areas in other parts of the county. The slopes are typically short. Individual areas are often irregular in shape and range from 2 to 5 acres.

Typically, the surface layer is mixed very dark grayish brown and brown loam about 8 inches thick. Plowing has mixed subsoil material into the surface layer. The subsoil is about 24 inches thick. The upper part of the subsoil is dark yellowish brown, friable clay loam; and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown and yellowish brown loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of Storden soils on steeper convex slopes that are severely eroded. Excess lime adversely affects the response of soil to fertilizer and herbicides. Also included on knobs are small areas of droughty Salida soils. Included areas make up less than 5 percent of the map unit.

This Lester soil has high available water capacity. Permeability is moderate. Surface runoff is very rapid. Tilth is generally good. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 2 percent organic matter. The subsoil is medium in available phosphrus and very low in available potassium.

Most areas of this soil are used for pasture or are cultivated. This soil is poorly suited to corn, soybeans,

and other cultivated crops and to small grains. It is moderately suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of further erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Contouring and terracing are difficult because of the undulating topography and short slopes, but most areas are suitable for these practices. Pasture and hay also help to control erosion. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting and increases water infiltration.

If this soil is used for trees, special equipment may be needed because of the slope. A plant cover is needed at all times to reduce erosion.

This soil is in capability subclass IVe.

236F—Lester loam, 18 to 25 percent slopes. This steep, well drained soil is on upland escarpments adjacent to streams on lake benches. This soil is below areas of less sloping Lester or Kilkenny soils. Individual areas range from 3 to 25 acres.

Typically, the surface layer is very dark gray loam about 6 inches thick. The subsurface layer is dark grayish brown loam about 3 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, friable clay loam, and the lower part is dark yellowish brown, friable loam. The substratum is light olive brown and yellowish brown loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of Terril soils on foot slopes of escarpments and Coland soils along narrow streams and drainageways that dissect the uplands. Also included are small areas of Palms soils in seepage areas on the sides of upland escarpments. Included areas make up less than 10 percent of the map unit.

This Lester soil has high available water capacity. Permeability is moderate. Surface runoff is very rapid. Tilth is generally good. This soil is generally acid. The surface layer contains about 2 percent organic matter. The subsoil is medium in available phosphorus and very low in available potassium.

Most areas of this soil are used for trees or pasture. This soil is moderately suited to trees and to grasses and legumes for hay and pasture. It is generally unsuitable for cultivated crops because of the erosion hazard and the danger of operating farm machinery on the steep slopes. It is poorly suited to use for most kinds of sanitary facilities and building sites.

If this soil is used for trees, a plant cover should be maintained to reduce the erosion hazard. Special equipment may be needed because of the slope. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass VIe.

274—Rolfe silt loam, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in depressions on the uplands. Slopes are short and concave. This soil is subject to ponding. Individual areas are generally circular and range from 2 to 8 acres.

Typically, the surface layer is black silt loam about 9 inches thick. The subsurface layer is gray silt loam about 12 inches thick. The subsoil extends to a depth of 43 inches. It is olive gray, firm silty clay in the upper part and olive gray, firm clay loam in the lower part. The substratum is dark grayish brown loam to a depth of about 60 inches.

Included with this soil in mapping on stream benches are areas of soils that have a sandy substratum. These areas make up less than 5 percent of the map unit.

This Rolfe soil has high available water capacity. Permeability is slow. This soil is ponded after heavy rains and has a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is tilled when wet. Shrink-swell potential is moderate or high. The soil is generally acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 5 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are drained and cultivated. Undrained areas are used for wetland wildlife habitat and pasture. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses for hay and pasture. Undrained areas are poorly suited to pasture. This soil is poorly suited to use for sanitary facilities and building sites.

Wetness limits crop production. Even if drained, this soil is susceptible to wetness and ponding after heavy rains and during spring thaw. Because of the slowly permeable subsoil, subsurface drainage systems may not remove excess water satisfactorily. Surface water intakes help to remove ponded water.

The tilth of the surface layer is easily damaged by grazing livestock. Stocking or grazing should be restricted during wet periods. Many legumes are winter-killed or drown in spring. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

284—Flagler sandy loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on stream benches and in upland outwash areas. This soil is subject to flooding. Individual areas range from 2 to 15 acres.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsurface layer is very dark brown sandy loam about 8 inches thick. The subsoil extends to a depth of 36 inches. It is dark brown, very

friable sandy loam in the upper part and brown and dark yellowish brown, very friable loamy sand in the lower part. The substratum is yellowish brown loamy sand and gravelly sand to a depth of about 84 inches. In some places the surface layer is gravelly sandy loam.

Included with this soil in mapping are a few steeper slopes and escarpments. These areas are more shallow to sand and gravel and have an erosion hazard. They make up less than 5 percent of the map unit.

This Flagler soil has low available water capacity and is droughty in years of normal or below-normal rainfall. Permeability is moderately rapid in the upper part of the subsoil and very rapid in the lower part and the sandy substratum. Surface runoff is slow. Tilth is good. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 2 percent organic matter. The subsoil is generally very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and well suited to use for building sites.

If cultivated, this soil is subject to wind erosion. Cultivating after heavy rains helps to prevent damage to young plants from blowing sand grains. Conservation tillage and winter cover crops help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIs.

284B—Flagler sandy loam, 2 to 5 percent slopes. This gently slopng, somewhat excessively drained soil is on stream benches and in upland outwash areas. Slopes are short and convex. This soil is subject to flooding. Individual areas range from 2 to 15 acres.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsurface layer is very dark brown sandy loam about 7 inches thick. The subsoil extends to a depth of 35 inches. It is dark brown, very friable sandy loam in the upper part; brown, very friable loamy sand in the middle part; and dark yellowish brown, very friable loamy sand in the lower part. The substratum is yellowish brown loamy sand, coarse sand, and gravelly sand to a depth of 84 inches. In some places the surface layer is gravelly sandy loam.

Included with this soil in mapping are a few steeper slopes and escarpments. These areas have sand and gravel at shallower depths and have a more severe erosion hazard. Also included are a few small areas along the Winnebago River where limestone bedrock is at a depth of less than 40 inches. Included areas make up less than 5 percent of the map unit.

This Flagler soil has low available water capacity. Permeability is moderately rapid in the upper part of the subsoil and very rapid in the lower part and the sandy substratum. Surface runoff is medium. Tilth is good. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 2 percent organic matter. The subsoil is generally very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and well suited to use for building sites.

Drought and erosion limit crop production. Wind erosion is a hazard if the soil is cultivated. Cultivating after heavy rains helps to prevent damage to young plants from blowing sand grains. Conservation tillage and winter cover crops help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

284C—Flagler sandy loam, 5 to 9 percent slopes. This moderately sloping, somewhat excessively drained soil is on stream benches and in upland outwash areas. Slopes are short and convex. This soil is subject to flooding. Individual areas range from 2 to 10 acres.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsurface layer is very dark brown sandy loam about 4 inches thick. The subsoil extends to a depth of 30 inches. It is brown, very friable sandy loam in the upper part and brown and dark yellowish brown, very friable loamy sand in the lower part. The substratum is yellowish brown loamy sand and gravelly sand to a depth of about 84 inches. In some places the surface layer is gravelly sandy loam.

Included with this soil in mapping are a few severely eroded areas on the steeper slopes. These areas are so droughty and infertile that establishing cover crops is difficult. These areas make up less than 5 percent of the map unit.

This Flagler soil has low available water capacity. Permeability is moderately rapid in the upper part of the subsoil and very rapid in the lower part and the sandy substratum. Surface runoff is medium. Tilth is good. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 2 percent organic matter. The subsoil is generally very low in available phosphorus and potassium.

Most areas of this soil are cultivated or are used for pasture. This soil is poorly suited to cultivated crops and small grains. It is moderately suited to grasses and

legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and moderately suited to building sites.

Drought and erosion limit crop production. Wind erosion is a hazard if the soil is cultivated. Cultivating after heavy rains helps to prevent damage to young plants from blowing sand grains. Conservation tillage and winter cover crops help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

325—Le Sueur loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is in swales and on knolls on gently undulating uplands. Slopes are typically short. Individual areas are irregular in shape and range from 2 to 5 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 3 inches thick. The subsoil is dark grayish brown, friable loam in the upper part and grayish brown, friable loam in the lower part. It extends to a depth of 35 inches. The substratum is grayish brown and light olive brown, calcareous loam to a depth of about 60 inches.

This Le Sueur soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. Tilth is generally good. Shrink-swell potential is moderate. This soil is generally acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is medium in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and building sites.

This soil is susceptible to slight wetness in rainy seasons. Subsurface drainage improves timeliness of tillage operation. There is some erosion in cultivated areas where longer slopes approach 3 percent. Conservation tillage and winter cover crops help to prevent excessive soil loss. Contouring and terracing are difficult because of the undulating topography and short slopes, but most areas are suitable for these practices. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and excessive runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability class I.

329—Webster-Nicollet complex, 1 to 3 percent slopes. This complex consists of undulating to very gently sloping, somewhat poorly drained and poorly drained soils on the uplands. Individual areas of this unit range from 3 acres to more than 100 acres in size. This complex is about 60 percent Webster soil and 40 percent Nicollet soil. The Webster soil is in the concave swales and waterways, and the Nicollet soil is on the more sloping, convex knolls. Areas of the two soils are so intricately mixed or so small in size that it was not practical to separate them in mapping.

Typically, the Webster soil has a surface layer of black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 9 inches thick. The subsoil extends to a depth of about 37 inches. It is very dark gray, friable silty clay loam in the upper part; olive gray and dark gray, friable clay loam in the middle part; and olive gray, friable, calcareous silty clay loam in the lower part. The substratum is light olive gray, calcareous clay loam to a depth of 60 inches.

Typically, the Nicollet soil has a surface layer of black loam about 8 inches thick. The subsurface layer is about 15 inches thick and is black loam in the upper part and very dark grayish brown loam in the lower part. The subsoil is dark grayish brown and olive brown, friable loam to a depth of 29 inches. The substratum is light olive brown, calcareous loam to a depth of about 60 inches.

Included with these soils in mapping are some small areas of Okoboji and Rolfe soils in depressions that pond water. Also included are some areas of gently sloping Terril soils on the foot slopes of adjacent knobs in gently rolling to steep areas. Included areas make up less than 10 percent of the map unit.

These Webster and Nicollet soils have high available water capacity. Permeability is moderate. Surface runoff is slow. These soils have a seasonal high water table. The surface layer of the Webster soil becomes cloddy and puddled if it is tilled when wet. The surface layer is typically neutral or slightly acid and seldom needs lime.

The Webster soil contains about 7 percent organic matter in the surface layer, and the Nicollet soil contains about 5 percent. The subsoil is very low in available phosphorus and very low or low in available potassium.

Most areas of these soils are cultivated. These soils are well suited to corn, soybeans, and other cultivated crops and to small grains. They are also well suited to grasses and legumes for hay and pasture. These soils are poorly suited to use for most sanitary facilities and building sites because of wetness.

If large areas of these soils are plowed in fall, wind erosion is a hazard. Conservation tillage and winter cover crops help to prevent excessive erosion. Wetness limits crop production. Subsurface drainage is needed for optimum production.

If these soils are used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This complex is in capability subclass IIw.

335—Harcot loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on stream benches and outwash plains that border streams and drainageways. This soil is subject to short floods. Individual areas are 2 to over 100 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black loam about 14 inches thick. The subsoil is light olive gray, friable loam to a depth of 33 inches. The substratum is light brownish gray gravelly sand to a depth of about 60 inches.

Included with this soil in mapping are a few small areas of Palms soils in depressions that pond water. These areas make up about 2 to 5 percent of the map unit.

This Harcot soil has moderate or low available water capacity. Permeability is moderate in the subsoil and very rapid in the sandy substratum. Surface runoff is slow. This soil has a seasonal high water table. This soil typically has good tilth but becomes cloddy if tilled when wet. Shrink-swell potential is moderate in the surface layer and subsoil. This soil is moderately alkaline and has excess lime in the surface layer. The surface layer contains about 5 percent organic matter. The subsoil is very low in available phosphorus and potassium. In many places the available iron is not sufficient for soybeans. The excess lime reduces the effect of fertilizer and herbicides on crops.

Most areas of this soil are drained and cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for most sanitary facilities and building sites.

Wetness and excess lime limit crop production. Placement of subsurface drainage lines is difficult in some places because of the loose, water-bearing sands. Iron chlorosis and damage from herbicide carryover are common in soybeans on this soil. Proper selection and use of soybean varieties, herbicides, and fertilizers minimizes these problems. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

354—Aquolls and Histosols. These nearly level, poorly drained and very poorly drained soils are in depressions and on uplands, stream benches, and bottom lands. These soils are subject to flooding and ponding. Individual areas are circular and range from 3 to 60 acres.

No one pedon is typical of Aquolls, but commonly the surface layer is black clay loam, silty clay loam, or mucky silt loam. It is about 10 inches thick. The subsurface layer is black and very dark gray clay loam or silty clay loam with prominent mottles and is about 10 to 30 inches thick. The substratum extends to a depth of about 60 inches and is dark gray to bluish gray clay loam, silty clay loam, or loam.

No one pedon is typical of Histosols, but commonly the surface layer is black sapric or hemic material about 10 inches thick. The subsurface layer is about 20 to 40 inches thick and is also black sapric or hemic material. The substratum extends to a depth of about 60 inches and is very dark gray or dark gray silty clay loam, silt loam, clay loam, or loam.

Included with these soils in mapping are small areas of Okoboji, Palms, Houghton, Faxon, and Tilfer soils. Okoboji, Palms, and Houghton soils are in depressions. Faxon and Tilfer soils are in slightly higher areas on the bottom lands. These soils make up less than 15 percent of the map unit.

Available water capacity of Aquolls and Histosols is high. Permeability is variable but is usually moderate, moderately slow, or slow. Surface runoff is very slow or ponded. The content or organic matter is about 9 to 18 percent in Aquolls and 35 to 60 percent in Histosols. Reaction ranges from medium acid to mildly alkaline throughout. These soils are very low in available phosphorus and potassium. These soils have a seasonal high water table. Many areas contain small ponds or lakes where the water table is at or near the surface all year.

Most areas of these soils remain idle or are used for wetland wildlife habitat. Most areas are covered by water during much of the growing season. These soils are unsuitable for cultivated crops, hay, pasture, or trees. They are poorly suited to use for most kinds of sanitary facilities and building sites. They are well suited to wetland wildlife habitat.

These soils are in capability subclass VIIw.

377—Dinsdale silty clay loam, 0 to 2 percent slopes. This nearly level, well drained soil is on uplands where limestone bedrock is at a depth of 5 to 20 feet. Individual areas range from 3 acres to more than 100 acres.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 9 inches thick. The subsoil is about 33 inches thick. The upper part of the subsoil is dark yellowish brown, friable silty clay loam; and the lower part is yellowish brown, firm loam. The substratum is yellowish brown, mottled, firm loam to a depth of about 60 inches.

Included with this soil in mapping are small areas where limestone bedrock is at a depth of 40 to 60 inches. These areas make up less than 5 percent of the map unit.

This Dinsdale soil has high available water capacity. Permeability is moderate. Surface runoff is slow. Tilth is good. Reaction is typically neutral or slightly acid in the surface layer and medium acid or strongly acid in the most acid part of the subsoil. The surface layer contains about 4 percent organic matter. The subsoil is typically low in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is well suited to use for most kinds of sanitary facilities and building sites.

Conservation tillage and winter cover crops help to prevent excessive wind erosion on large cultivated areas. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

377B—Dinsdale silty clay loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on slightly convex crests and sides of ridges in the uplands. Individual areas range from 2 to 70 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 9 inches thick. The subsoil is about 33 inches thick. The upper part is dark yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable and firm loam. The substratum is yellowish brown and grayish brown, firm loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of soils that have dense gray clay below a depth of 20 to 36 inches. These areas make up less than 5 percent of the map unit.

This Dinsdale soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is good. Reaction is typically neutral or slightly acid in the surface layer and medium acid or strongly acid in the most acid part of the subsoil. The surface layer contains about 4 percent organic matter. The subsoil is typically low in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is well suited to use for most sanitary facilities and building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. The uniform slopes are well suited to contour cultivation and terraces, which slow movement of surface water and reduce erosion. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

382—Maxfield silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad upland divides and in shallow drainageways. Individual areas range from 3 acres to more than 100 acres.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is about 12 inches thick and is black silty clay loam in the upper part and very dark gray silty clay loam in the lower part. The subsoil extends to a depth of 46 inches. The upper part of the subsoil is mottled dark gray and olive, friable silty clay loam; the middle part is olive, friable silt loam; and the lower part is strong brown, mottled, firm loam. The substratum is strong brown, calcareous loam to a depth of about 66 inches.

This Maxfield soil has high available water capacity. Permeability is moderate. Surface runoff is slow. The surface layer becomes cloddy and puddled if the soil is wet. This soil is neutral and seldom needs lime. The surface layer contains about 7 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are drained and cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

Wetness limits crop production. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

391B—Clyde-Floyd complex, 1 to 4 percent slopes. This complex consists of nearly level and gently sloping, poorly drained and somewhat poorly drained soils on lower side slopes and in small upland drainageways. Individual areas are typically long and narrow and range from 3 acres to more than 30 acres. This complex is 50 percent Clyde soil and 50 percent Floyd soil. In most places the Clyde soil is in the center of the drainageway and the Floyd soil is in a band bordering the drainageway. The Clyde soil is subject to flooding. Areas of the two soils are so intricately mixed or so small in size that it was not practical to separate them in mapping.

Typically, the Clyde soil has a surface layer of black silty clay loam about 8 inches thick. The subsurface layer is about 12 inches thick and is black silty clay loam in the upper part and mottled dark grayish brown and very dark gray silty clay loam in the lower part. The subsoil extends to a depth of 48 inches. It is olive gray, friable silty clay loam in the upper part; yellowish brown, very friable sandy loam in the middle part; and gray and dark gray, firm loam in the lower part. The substratum is yellowish brown and gray loam to a depth of about 72 inches.

Typically, the Floyd soil has a surface layer of black loam about 8 inches thick. The subsurface layer is black clay loam about 13 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is olive brown, friable clay loam with dark grayish brown mottles; the middle part is yellowish brown, friable sandy clay loam; and the lower part is mottled yellowish brown and grayish brown, firm sandy clay loam. The substratum is mottled light brownish gray and strong brown loam to a depth of about 78 inches.

These Clyde and Floyd soils have high available water capacity. Permeability is moderate. These soils receive runoff and seepage from adjacent areas and have a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is worked when wet. Shrink-swell potential is moderate in the surface layer. These soils are typically neutral in the surface layer and seldom need lime. These soils contain 6 to 8 percent organic matter in the surface layer. The subsoil is typically very low in available phosphorus and potassium.

Most areas of these soils are cultivated. These soils are well suited to corn, soybeans, and other cultivated crops and to small grains. They are also well suited to grasses and legumes for hay and pasture. These soils are poorly suited to use for most sanitary facilities and building sites.

If these soils are cultivated, there is a hazard of erosion in the drainageways that receive runoff from large areas. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Subsurface drainage is needed for maximum crop production. Subsurface drainage and terraces are commonly used together in these soils to control erosion and remove excess water.

If these soils are used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This complex is in capability subclass IIw.

398—Tripoli silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on long, slightly concave to very slightly convex side slopes on broad upland flats and in shallow drainageways. Individual areas range from 3 acres to more than 100 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is 10 inches thick and is black silty clay loam in the upper part and very dark gray silty clay loam in the lower part. The subsoil is about 18 inches thick. It is olive gray, friable clay loam in the upper part and yellowish brown, friable loam in the lower part. The substratum is mottled, strong brown loam to a depth of about 60 inches.

This Tripoli soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is tilled when wet. The surface layer is neutral or sightly acid and seldom needs lime. The plow layer contains about 7 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

Wetness limits crop production. Subsurface drainage is needed for maximum production.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class IIw.

399—Readlyn loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on slightly convex crests and sides of ridges on the uplands. Individual areas range from 5 acres to more than 200 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown

loam about 9 inches thick. The subsoil is about 33 inches thick. The upper part of the subsoil is brown, friable loam; the middle part is grayish brown and olive brown, firm loam; and the lower part is strong brown and grayish brown, firm loam. The substratum is mottled grayish brown and strong brown loam to a depth of about 60 inches.

This Readlyn soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. Tilth is good. This soil is generally acid in the plow layer if it has not been limed in the last 5 years. The surface layer contains about 5 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is moderately suited to use for sanitary facilities and building sites.

The more sloping areas of this soil are subject to slight erosion if cropped. Subsurface drainage helps to improve timeliness of tillage operations. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

407B—Schley loam, 1 to 4 percent slopes. This very gently sloping and gently sloping, somewhat poorly drained soil is on slightly concave lower side slopes adjacent to drainageways on the uplands. Slopes are typically long. Individual areas are 2 to 4 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsoil extends to a depth of 48 inches. The upper part of the subsoil is brown, grayish brown, and yellowish brown, friable loam; the middle part is grayish brown and brown, very friable sandy loam; and the lower part is pale brown and brown, mottled, friable loam. The substratum is light yellowish brown and strong brown, mottled loam and sandy loam to a depth of about 76 inches.

Included with this soil in mapping on the lower part of side slopes are small areas of Donnan soils, which have dense gray clay below a depth of 20 to 36 inches. These soils produce seepage during wet periods. They make up less than 5 percent of the map unit.

This Schley soil has high available water capacity. This soil is moderately permeable but is more permeable in the upper part of the subsoil than in the lower part and the substratum. Surface runoff is slow. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is tilled when wet. This soil is generally acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 3 percent organic mater. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is moderately suited to trees and poorly suited to use for sanitary facilities and building sites.

Wetness limits crop production. A drainage system that intercepts laterally moving seepage water is the most successful sort. The more sloping areas of this soil are subject to slight erosion if cultivated. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for trees, special equipment may be needed during wet periods. Tree seeds, cuttings, and seedlings survive and grow well.

This soil is in capability subclass IIw.

412C—Sogn loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, excessively drained soil is on escarpments and ridge crests on the uplands and stream benches. Slopes are typically short. Individual areas range from 2 to 50 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsurface layer is brown and dark brown loam about 3 inches thick. Hard, shattered, level-bedded limestone bedrock is at a depth of 11 inches.

This Sogn soil has very low available water capacity and is droughty. Permeability is moderate. Surface runoff is medium. Tillage is difficult because of outcrops of limestone bedrock. The root zone is severely limited by the bedrock. This soil ranges from slightly acid to moderately alkaline and seldom needs lime. The surface layer contains about 3 percent organic matter. Available phosphorus and potassium are very low. Crops respond poorly to fertilizer because of the limited root zone and very low available water capacity.

Most areas of this soil are in pasture. This soil is poorly suited to corn, soybeans, and other cultivated crops; to hay and pasture; and to trees. It is also poorly suited to use for sanitary facilities and building sites.

If cultivated or intensively pastured, this soil is susceptible to erosion. Pasture plants become dormant during dry periods. Proper stocking, pasture rotation, and timely deferment of grazing help to prevent overgrazing during droughty periods. This soil is susceptible to erosion if overgrazed.

This soil is in capability subclass IVs.

412E—Sogn loam, 9 to 18 percent slopes. This strongly sloping and moderately steep, excessively drained soil is on escarpments on the uplands and stream benches. Slopes are short. Individual areas are long and narrow and range from 2 to 20 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. Hard, shattered, level-bedded limestone bedrock is at a depth of about 8 inches.

This Sogn soil has very low available water capacity and is droughty. Permeability is moderate. Surface runoff is rapid. Tillage is practically impossible because of outcrops of limestone bedrock. The root zone is severely limited by the bedrock. This soil ranges from slightly acid to moderately alkaline and seldom needs lime. The surface layer contains about 3 percent organic matter. Available phosphorus and potassium are very low. Crops respond poorly to fertilizer because of the limited root zone and very low available water capacity.

Most areas of this soil are used for pasture and trees. This soil is generally unsuitable for corn, soybeans, and other cultivated crops and for small grains. It is poorly suited to hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and building sites.

Reestablishing vegetation for improved pasture without equipment damage and excessive soil loss is difficult. Pasture plants become dormant during dry periods. Proper stocking, pasture rotation, and timely deferment of grazing help to prevent overgrazing during droughty periods. This soil is susceptible to erosion if overgrazed.

This soil is in capability subclass VIs.

444—Jacwin silty clay loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on slightly convex to slightly concave side slopes on low uplands or high stream benches. Slopes are typically long and uniform. Individual areas range from 3 acres to more than 50 acres.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black silty clay loam about 10 inches thick. The subsoil extends to a depth of 48 inches. The upper part of the subsoil is dark grayish brown, friable silty clay loam; the middle part is olive yellow, very friable silt loam; and the lower part is olive, mottled, extremely firm silty clay. The substratum is olive and greenish gray silty clay shale. In places, the depth to shale is less than 20 inches.

Included with this soil in mapping are small areas of Floyd and Lawler soils, which do not have shale above a depth of 60 inches. In a few areas the upper 1 to 3 feet of the susbstratum is weathered limestone that contains many hard fragments. These differences increase lateral flow of water above the shale to drainage lines. Included areas make up less than 10 percent of the map unit.

This Jacwin soil has moderate or high available water capacity. Permeability is moderate in the upper part of the subsoil and very slow in the lower part. Surface runoff is medium. This soil has a seasonal perched water table. The surface layer becomes cloddy and puddled if the soil is tilled when wet. This soil is neutral or slightly acid and seldom needs lime. The surface layer contains about 7 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary faclities and building sites.

Wetness limits crop production. Seepy areas are common because of lateral flow of water perched on the shale. Drainage lines should be installed in a pattern that will intercept the water flowing laterally over the shale. Subsurface drainage systems do not always function well, and drainage lines may need to be more closely spaced than in soils that have less clay in the substratum. The silty clay shale in the substratum forces careful placement of the drainage lines and proper backfilling.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

457—Du Page silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flood plains. It is subject to flooding. Individual areas range from 15 to 100 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark brown silt loam about 52 inches thick. In a few places the surface layer is sandy loam.

This Du Page soil has very high available water capacity. Permeability is moderate. Surface runoff is slow. Tilth is normally good. This soil is mildly alkaline or moderately alkaline and does not need lime. The surface layer contains about 5 percent organic matter. The subsoil is very low in available phosphorus and very low in available potassium. In many places the supply of iron is not sufficient for soybeans. An excess of lime reduces the effect of fertilizer and herbicides on crops.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

If this soil is cultivated, there is some hazard of crop loss because of flooding. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

471—Oran silt loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on

slightly convex crests and sides of ridges on the uplands. Slopes are typically long and uniform. Individual areas range from 3 acres to more than 100 acres.

Typically, the surface layer is about 8 inches thick and is very dark brown silt loam that is high in sand. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil extends to a depth of 41 inches. The upper part of the subsoil is dark grayish brown, friable loam; and the lower part is mottled grayish brown and yellowish brown, firm loam. The substratum is mottled light brownish gray and yellowish brown, calcareous loam to a depth of about 72 inches.

Included with this soil in mapping are some small areas of Cerlin soils, which have dense gray clay below a depth of 20 to 36 inches. These soils produce seepage during wet periods. They make up less than 5 percent of the map unit.

This Oran soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal perched high water table. Tilth is generally good. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and building sites.

If this soil is cultivated, subsurface drainage improves timeliness of tillage operations. The more sloping areas of this soil are subject to slight erosion if cultivated. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

If this soil is used for trees, subsurface drainage may be needed to improve the timeliness of operations.

This soil is in capability class I.

507—Canisteo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained, calcareous soil is in concave upland swales. In some areas this soil borders depressions and waterways. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black clay loam about 10 inches thick. The subsoil is about 18 inches thick. It is dark gray, friable clay loam in the upper part and olive gray, friable loam in the lower part. The substratum extends to a depth of about 68 inches, and is olive gray loam in the upper part and stratified loam, silt loam, and sandy loam in the lower part.

Included with this soil in mapping are small depressions that pond water, small well drained humps that are susceptible to erosion, and small sand spots that are droughty. These areas make up less than 5 percent of the map unit.

This soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if this soil is worked when wet. Shrink-swell potential is moderate to high. This soil is mildly alkaline and does not need lime. It is calcareous throughout. The surface layer contains about 7 percent organic matter. The subsoil is very low in available phosphorus and potassium. An excess of lime in this soil reduces the effect of fertilizer and herbicides on crops.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. This soil is also well suited to legumes for hay and pasture. This soil is poorly suited to use for most sanitary facilities and building sites.

Drainage is needed for optimum crop production. If large areas are plowed in fall, wind erosion is a hazard. Conservation tillage and crop residue left on the surface help to prevent wind erosion.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

536—Hanlon fine sandy loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on natural levees along streams. Slopes are slightly convex. This soil is subject to flooding. Individual areas are 2 to 25 acres.

Typically, the surface layer is black fine sandy loam about 12 inches thick. The subsurface layer is about 36 inches thick and is black fine sandy loam in the upper part and very dark gray fine sandy loam in the lower part. The substratum is very dark grayish brown sandy loam to a depth of about 60 inches. In places the subsurface layer is underlain by bedrock.

Included with this soil in mapping are areas where the surface layer is calcareous, reducing the effect of fertilizer and herbicides on crops. Also included are small areas with limestone outcrops; these areas are more droughty. Included areas make up less than 5 percent of the map unit.

This Hanlon soil has moderate available water capacity and is somewhat droughty during extended dry periods. Permeability is moderately rapid. Surface runoff is slow. This soil is frequently flooded for short periods. Tilth is good. This soil is neutral or slightly acid and seldom needs lime. The surface layer contains about 3

percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated or are used for pasture. Many areas that are frequently flooded or are associated with shallow soils are in pasture. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and building sites.

If this soil is cultivated, conservation tillage and winter cover crops help to prevent excessive soil loss from spring floods. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

Tree seeds, cutting and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIs.

551—Calamine silty clay loam, 1 to 3 percent slopes. This very gently sloping, poorly drained soil is in broad, nearly level areas in upland swales, in drainageways, and on foot slopes below areas of friable arenaceous limestone. Individual areas range from 3 to 50 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 10 inches thick. The subsoil is olive gray silty clay about 15 inches thick. The substratum is mottled greenish gray and olive yellow, calcareous silty clay shale to a depth of about 60 inches.

Included with this soil in mapping are some areas of soils that have weathered limestone at a depth of 20 to 40 inches. Also included are areas where the surface layer is calcareous, reducing the effect of fertilizer and herbicides on crops. Included areas make up less than 5 percent of the map unit.

This Calamine soil has moderate or high available water capacity. Permeability is moderate in the upper part of the subsoil and very slow in the lower part and the substratum. This soil has a seasonal high water table. It receives seepage and runoff from higher soils. Surface runoff is slow. The surface layer becomes cloddy and puddled if this soil is worked when wet. Shrink-swell potential is moderate because of large amounts of illitic clay minerals. The surface layer is neutral to mildly alkaline and does not need lime. The surface layer contains about 8 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. If drained, this soil is moderately suited to corn, soybeans, and other cultivated crops; to small grains; and to grasses and legumes for hay or pasture. Undrained areas are commonly used for permanent pasture. This soil is poorly suited to trees and to use for sanitary facilities and building sites.

This soil is susceptible to wetness in rainy seasons even if drained. Subsurface drainage lines need to be spaced more closely than in soils that have less clay in the subsoil. The dense silty clay shale in the lower part of the subsoil forces careful placement of subsurface drainage lines and proper backfilling.

Special equipment may be needed for forestry operations because this soil has a seasonal water table and remains wet for long periods after rains. Artificial drainage is needed to reduce seedling mortality. The shale substratum restricts root development.

This soil is in capability subclass IIIw.

558—Talcot clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is on stream benches and in upland alluvial areas. Individual areas range from 3 to 40 acres.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 10 inches thick. The subsoil extends to a depth of 27 inches. The upper part of the subsoil is dark gray and olive, friable clay loam; and the lower part is olive gray and olive, friable loam. The substratum is yellowish brown loamy sand and light brownish gray gravelly sand to a depth of about 60 inches. Depth to sand and gravel is 16 to 24 inches in a few places.

This Talcot soil has low or moderate available water capacity. Permeability is moderate in the upper part of the subsoil and rapid in the lower part and the substratum. Surface runoff is slow. This soil has a seasonal high water table. Some low areas are subject to flooding. The surface layer becomes cloddy and puddled if the soil is tilled when wet. Shrink-swell potential is moderate in the surface layer and subsoil. This soil is moderately alkaline and does not need lime. The surface layer contains about 6 percent organic matter. The subsoil is very low in available phosphorus and potassium. An excess of lime reduces the effect of fertilizer and herbicides on crops.

Most areas of this soil are cultivated. If adequately drained, this soil is well suited to corn, soybeans, and other cultivated crops; to small grains; and to grasses and legumes for hay and pasture. Undrained areas are well suited to wetland wildlife habitat and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

Wetness and excess lime limit crop production. Drainage is needed for optimum crop production. Placement of subsurface drainage lines is difficult in some places because of the loose, water-bearing sands. This soil is also susceptible to drought during prolonged dry seasons. If large areas are plowed in fall, wind erosion is a hazard. Conservation tillage and crop residue left on the surface help to prevent wind erosion.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

559—Talcot clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is on stream benches and in upland alluvial areas. Individual areas range from 3 to 40 acres.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 12 inches thick. The subsoil extends to a depth of 33 inches. The upper part of the subsoil is dark gray and olive, friable clay loam; and the lower part is olive gray and olive, friable loam. The substratum is yellowish brown loamy sand and light brownish gray gravelly sand to a depth of about 60 inches. Depth to sand and gravel is 40 to 48 inches in a few places.

This Talcot soil has moderate available water capacity and is droughty during prolonged dry seasons. Permeability is moderate in the upper part of the subsoil and rapid in the lower part and in the substratum. Surface runoff is slow. This soil has a seasonal high water table. Some low areas are subject to flooding. The surface layer becomes cloddy and puddled if the soil is tilled when wet. Shrink-swell potential is moderate in the surface layer and subsoil. This soil is moderately alkaline and does not need lime. The surface layer contains about 6 percent organic matter. The subsoil is very low in available phosphorus and potassium. An excess of lime reduces the effect of fertilizer and herbicides on crops.

Most areas of this soil are cultivated. If adequately drained, this soil is well suited to corn, soybeans, and other cultivated crops; to small grains; and to grasses and legumes for hay and pasture. Undrained areas are well suited to wetland wildlife habitat and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

Wetness and excess lime limit crop production. Drainage is needed for optimum crop production. Placement of subsurface drainage lines is difficult in some places because of the loose, water-bearing sands. If large areas are plowed in fall, wind erosion is a hazard. Conservation tillage and crop residue left on the surface help to prevent wind erosion.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

583—Minnetonka silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on low knolls and in swales and drainageways in the uplands. The slopes are typically short. Individual areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 9 inches thick. The subsoil extends to a depth of 42 inches. It is very dark gray, firm silty clay in the upper part and gray, firm silty clay in the middle and lower parts. The substratum is olive gray, firm, calcareous silty clay loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of depressional Okoboji and Rolfe soils, which pond water. These areas make up less than 10 percent of the map unit.

This Minnetonka soil has high available water capacity. Permeability is slow. Surface runoff is slow. This soil has a seasonal high water table. This soil has poor tilth and requires extra power for tillage. Reaction is neutral to medium acid in the surface layer and subsoil. The surface layer contains about 7 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. This soil is moderately suited to cultivated crops and pasture. It is well suited to wetland wildlife habitat. This soil is poorly suited to use for sanitary facilities and building sites.

If this soil is cultivated, the major limitations are wetness and poor tilth. Subsurface drainage is beneficial. The high clay content of this soil slows water movement; therefore, drainage lines must be placed more closely than usual. Even if this soil is drained, good timing of tillage operations is important to prevent compaction. Extra tillage is often needed to break clods for a good seedbed.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The high water table limits use of this soil for trees. Surface or subsurface drainage is needed to reduce seedling mortality and equipment limitations.

This soil is in capability subclass IIw.

611—Rossfield Variant silty clay loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on concave heads of upland drainageways. Slopes are typically long and slightly concave. Individual areas are 3 to 15 acres.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is black silty clay loam about 10 inches thick. The subsoil extends to a depth of 38 inches. The upper part of the subsoil is dark grayish brown, friable silty clay loam; the middle part is dark grayish brown and yellowish brown, firm silty clay loam; and the lower part is yellowish brown, very

firm silty clay. The substratum extends to a depth of about 60 inches and is brownish yellow and pale olive, calcareous silty clay loam with about 25 percent hard limestone fragments.

Included with this soil in mapping are some small areas of Kensett soils, which are underlain by limestone bedrock at a depth of 20 to 40 inches, and small areas of Jacwin soils, which have a silty clay shale substratum. These areas make up less than 10 percent of the map unit.

This Rossfield Variant soil has high available water capacity. Permeability is slow. Surface runoff is slow. This soil has a seasonal high water table. The surface layer becomes crusted and puddled if the soil is tilled when wet. The surface layer is neutral or slightly acid and seldom needs lime. The surface layer contains about 7 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

Wetness limits crop production. Drainage is beneficial. The more sloping areas are subject to slight erosion when cultivated. Conservation tillage, winter cover crops, contouring, terraces, and grassed waterways help to prevent excessive soil losses. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

612B—Mottland loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on crests and sides of ridges in the uplands. Slopes are long and convex. Individual areas range from 2 to 25 acres.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The substratum is channery loam and channery fine sandy loam to a depth of about 60 inches.

Included with this soil in mapping are areas of Rockton and Sogn soils, which have hard limestone bedrock that is more difficult to excavate. Outcrops of this limestone make cultivation difficult, and the root zone is limited. These areas make up less than 5 percent of the map unit.

This Mottland soil has moderate available water capacity. Permeability is moderate in the surface layer and moderately rapid in the substratum. Runoff is medium. Tilth is good. Flagstones and limestone outcrops interfere with tillage in some areas. This soil is mildly alkaline or moderately alkaline and does not need lime. The surface layer contains about 3 percent organic matter. This soil is very low in available phosphorus and potassium. The calcareous surface layer reduces the effect of herbicides and fertilizer on crops.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

If this soil is cultivated, there is a hazard of erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent soil loss. Pasture and hay also control erosion. Terracing is difficult because cuts expose highly calcareous arenaceous limestone. Establishing vegetation on these cuts is difficult. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

612C2—Mottland loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained, calcareous soil is on crests and sides of ridges in the uplands. Slopes are generally short and convex. Individual areas range from 2 to 30 acres.

Typically, the surface layer is mixed very dark grayish brown and brown, calcareous loam about 8 inches thick. The substratum is channery loam and channery fine sandy loam to a depth of about 60 inches.

Included with this soil in mapping are areas of Rockton and Sogn soils, which have limestone bedrock that is more difficult to excavate. Outcrops of this limestone make cultivation difficult, and the root zone is limited. These areas make up less than 5 percent of the map unit.

This Mottland soil has moderate available water capacity. The permeability is moderate in the surface layer and moderately rapid in the substratum. Runoff is medium. Tilth is good. Flagstones and limestone outcrops interfere with tillage in some areas. This soil is mildly alkaline or moderately alkaline and does not need lime. The surface layer contains about 2 percent organic matter. The subsoil is very low in available phosphorus and potassium. The calcareous surface layer reduces the effect of herbicides and fertilizer on crops.

Most areas of this soil are cultivated or are used for hay and pasture. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

If this soil is cultivated, there is a hazard of erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent soil loss. Pasture and hay also control erosion. Terracing is difficult because cuts expose highly calcareous arenaceous limestone. Establishing vegetation on these cuts is difficult. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

612E2—Mottland loam, 9 to 18 percent slopes, moderately eroded. This strongly sloping and moderately steep, well drained, calcareous soil is on side slopes below less sloping Mottland soils. In some places this soil is on escarpments adjacent to stream benches and flood plains. Individual areas are 2 to 40 acres.

Typically, the surface layer is very dark grayish brown and brown, calcareous loam about 8 inches thick. The substratum is channery loam and channery fine sandy loam to a depth of about 60 inches.

Included with this soil in mapping are areas of Rockton and Sogn soils, which have limestone bedrock that is more difficult to excavate and that limit the root zone. Also included are areas of soils that have shale layers; these soils produce seepage during wet periods. Included areas make up less than 5 percent of the map unit.

This Mottland soil has moderate available water capacity. Permeability is moderate in the surface layer and rapid in the substratum. Runoff is rapid. Tilth is good. This soil is mildly alkaline or moderately alkaline. The surface layer contains about 2 percent organic matter. This soil is very low in available phosphorus and potassium. An excess of lime adversely affects growth of trees on this soil.

Most areas of this soil are used for pasture. This soil is poorly suited to cultivated crops. It is moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

If this soil is used for hay and pasture, overgrazing increases runoff and erosion.

This soil is in capability subclass IVe.

612G2—Mottland loam, 18 to 40 percent slopes, moderately eroded. This steep and very steep, well drained, calcareous soil is on side slopes and on escarpments adjacent to stream benches and flood plains. Individual areas are 2 to 40 acres.

Typically, the surface layer is very dark grayish brown and brown, calcareous loam about 8 inches thick. The substratum is channery fine sandy loam to a depth of about 60 inches.

Included with this soil in mapping are areas of Sogn soils, which have limestone bedrock that is difficult to excavate and that limits the root zone. Also included are areas of soils that have shale layers; these soils produce seepage during wet periods. Included areas make up less than 5 percent of the map unit.

This Mottland soil has moderate available water capacity. Permeability is moderate in the surface layer and rapid in the substratum. Surface runoff is rapid. Tilth is good. This soil is mildly alkaline or moderately alkaline. The surface layer contains about 2 percent organic matter. This soil is very low in available phosphorus and potassium. An excess of lime adversely affects growth of some trees on this soil.

Most areas of this soil are used for pasture and woodland wildlife habitat. This soil is generally unsuitable for cultivated crops. It is poorly suited to pasture and to native grasses and trees. This soil is generally unsuitable for sanitary facilities and building sites.

If this soil is used for pasture, overgrazing increases surface runoff and erosion. The slope limits use of machinery for establishing tree seedlings.

This soil is in capability subclass VIIe.

613—Rossfield silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is in broad areas on the uplands. Individual areas range from 4 acres to more than 100 acres.

Typically, the surface layer is very dark brown silt loam about 9 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil is about 16 inches thick. It is very dark grayish brown and yellowish brown, friable silty clay loam in the upper part and yellowish brown, friable clay loam in the lower part. The substratum is brownish yellow and olive yellow channery loam to a depth of about 60 inches. In some places the depth to the channery loam substratum is as much as 48 inches.

Included with this soil in mapping are areas of Rockton soils, which have limestone bedrock layers that are more difficult to excavate. These areas make up less than 5 percent of the map unit.

This Rossfield soil has high available water capacity. Permeability is moderate in the subsoil and moderately rapid in the substratum. Surface runoff is slow. Tilth typically is good. This soil is neutral or slightly acid and seldom needs lime. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is well suited to use for sanitary facilities and building sites.

If this soil is cultivated, returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

This soil is in capability class I.

613B—Rossfield silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on crests and sides of ridges in the uplands. Individual areas range from 3 to 100 acres.

Typically, the surface layer is very dark brown silt loam about 9 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil is about 16 inches thick. It is very dark grayish brown and yellowish brown, friable silty clay loam in the upper part and yellowish brown, friable clay loam in the lower part. The substratum is brownish yellow and olive yellow channery loam to a depth of about 60 inches. In some places the depth to the channery loam substratum is as much as 48 inches.

Included with this soil in mapping are areas of Rockton and Sogn soils, which have limestone bedrock layers that are more difficult to excavate. Outcrops of this bedrock make cultivation difficult and limit the root zone. These areas make up less than 10 percent of the map unit.

This Rossfield soil has high available water capacity. Permeability is moderate in the subsoil and moderately rapid in the substratum. Surface runoff is medium. Tilth typically is good. This soil is neutral or slightly acid and seldom needs lime. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is well suited to use for most sanitary facilities and building sites.

If this soil is cultivated, there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Pasture and hay also control erosion. The long, uniform slopes are well suited to contour cultivation and terraces. Terrace cuts should be minimized to avoid exposing the underlying material in the channel. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

613C—Rossfield silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on short, straight side slopes and concave lower side slopes on the uplands. Individual areas range from 3 to 20 acres.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 5 inches thick. The subsoil is about 16 inches thick. It is very dark grayish brown and yellowish brown, friable silty clay loam in the upper part and yellowish brown, friable clay loam in the lower part. The substratum is brownish yellow channery loam to a depth of about 60 inches. In some places the depth to the channery loam substratum is as much as 48 inches.

Included with this soil in mapping are areas of Rockton and Sogn soils, which have limestone bedrock layers that are more difficult to plow and that limit the root zone. Also included are small wet areas, some of which are mucky. These areas are artesian springs and are difficult to drain. In a few places slope is 9 to 11 percent. Included areas make up less than 10 percent of the map unit.

This Rossfield soil has high available water capacity. Permeability is moderate in the subsoil and moderately rapid in the substratum. Surface runoff is medium. Tilth typically is good. This soil is neutral or slightly acid and seldom needs lime. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are in pasture. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture. This soil, however, is associated with soils that are poorly suited to these uses because of steep slopes or hard limestone that limits rooting depth. Because of the drought and erosion problems of these adjacent soils, this Rossfield soil is used mainly for pasture. This soil is moderately suited to use for sanitary facilities and building sites.

If this soil is cultivated, there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

614B—Jacwin Variant loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex crests and sides of ridges in the uplands. Individual areas are 2 to 20 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown clay loam about 8 inches thick. The subsoil extends to a depth of 35 inches. It is brown and very dark grayish brown, friable clay loam in the upper part; dark yellowish brown, friable clay loam in the middle part, and light olive brown, very firm silty clay in

the lower part. The substratum is olive brown and light olive, calcareous silty clay shale to a depth of about 60 inches. Lenses of yellowish brown, friable channery loam are common in the upper part of the substratum.

Included with this soil in mapping are small, more sloping, eroded areas of Jacwin Variant soils that have silty clay shale near the surface. These areas are less fertile and are difficult to till. They make up less than 10 percent of the map unit.

This Jacwin Variant soil has moderate or high available water capacity. Permeability is moderate in the upper part of the subsoil and very slow in the lower part and the substratum. Surface runoff is medium. Tilth is typically good. The surface layer and subsoil are neutral or slightly acid and seldom need lime. The plow layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and well suited to use for building sites.

If this soil is cultivated, there is a hazard of erosion. Conservation tillage, grassed waterways, winter cover crops, and terraces help to prevent excessive soil loss. Pasture and hay also control erosion. The long, uniform slopes are well suited to contour cultivation and terraces. These practices slow the movement of water and let more of it soak into the soil, however, and this extra water complicates drainage, especially in wet years. A combination of terraces and subsurface drainage may be needed. Terrace excavations may expose the infertile silty clay shale, which is difficult to manage. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

614C3—Jacwin Variant silty clay loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, moderately well drained soil is on convex upland ridges. Slopes are typically short. Individual areas range from 2 to 20 acres.

Typically, the surface layer is dark grayish brown and olive brown silty clay loam about 8 inches thick. The subsoil is olive brown and pale olive, firm and very firm silty clay to a depth of 16 inches. The substratum is light olive gray and light olive brown, calcareous silty clay shale to a depth of about 60 inches. Some places have calcareous silty clay shale in the surface layer.

Included with this soil in mapping are small areas of calcareous Mottland soils above this soil on the ridge crests. Mottland soils have a more permeable, friable channery loam substratum. Also included are some uneroded areas that have a thicker surface layer. Included areas make up less than 5 percent of the map unit.

This Jacwin Variant soil has high available water capacity. Permeability is very slow. Seepy spots are on some of the lower slopes of this soil. Surface runoff is medium. Tilth is generally poor. The surface is cloddy when dry and becomes puddled when wet. The root zone is partially limited by the shale. The surface layer is neutral to moderately alkaline and does not need lime. The surface layer contains about 2 percent organic matter. The subsoil is very low in available phosphorus and very low to low in available potassium. In many places excess lime in the surface layer reduces the effect of herbicides and fertilizer on crops.

Most areas of this soil are cultivated. Some areas are used for pasture. This soil is poorly suited to corn, soybeans, and other cultivated crops and to small grains, but it is commonly associated with soils that are moderately suited to these uses. This soil is moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites. Small areas of this soil in cultivated fields are best suited to permanent vegetation for wildlife habitat.

If this soil is cultivated there is a severe hazard of further erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Pasture and hay also control erosion. Terrace cuts on this soil expose the shale, which is infertile and difficult to manage. Establishing vegetation on the infertile calcareous silty clay shale is difficult.

If this soil is for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IVe.

621—Houghton muck, 0 to 1 percent slopes. This level, very poorly drained soil is in depressions on the uplands, on stream benches, and on flood plains. This soil is subject to ponding. Individual areas range from 4 acres to more than 100 acres.

Typically, the surface layer is black sapric material about 9 inches thick. The subsurface layer is also black sapric material to a depth of about 60 inches. In places the subsurface layer is calcareous below a depth of 36 to 60 inches.

Included with this soil in mapping are a few areas that have a black or very dark brown loam or silt loam mineral layer 10 to 24 inches thick over the organic material. In some areas the organic surface layer is calcareous, reducing the effect of herbicides and fertilizer on crops.

This Houghton soil has very high available water capacity. Permeability is moderately rapid. This soil receives runoff from adjacent soils and has a seasonal high water table. Even if drained, this soil is susceptible to wetness and ponding after heavy rains and during spring thaw. There is a danger of early frost in fall. Tilth is good if the soil is adequately drained. This soil is neutral or mildly alkaline and does not need lime. Organic matter content of the surface layer is more than 70 percent. This soil is very low in available phosphorus and potassium.

This soil is poorly suited to corn, soybeans, small grains, and grasses and legumes for hay or pasture. It is moderately suited to specialty crops. The most common specialty crops are potatoes, onions, and carrots. If adequately drained, this soil is moderately suited to pasture. Undrained areas are well suited to wetland wildlife habitat. This soil is generally unsuitable for most sanitary facilities and building sites.

Wetness limits crop production. Lodging of small grains is a problem. Subsurface drainage lines are likely to settle out of alignment as the drained organic material subsides. Subsidence also affects the optimum depth of the drainage lines. Because of subsidence, the calcareous lower part of the soil will eventually become the surface layer, and the calcareous material will reduce the effect of herbicides and fertilizer on crops. A combination of lateral subsurface drainage lines and surface ditches is most successful in draining large areas of this soil. The ditches should be placed on the perimeter of the organic soil in order to have a stable base in mineral material. Nevertheless, the organic material may be subject to sloughing of side slopes.

The tilth of the spongy surface layer of this soil is easily damaged by grazing livestock. Stocking or grazing should be restricted during wet periods. Legumes commonly are winter-killed or drown. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

638C2—Clarion-Storden loams, 5 to 9 percent slopes, moderately eroded. This complex consists of moderately sloping, well drained soils on knobs, ridgetops, and side slopes of the uplands. Slopes are typically short. Individual areas are irregular in shape and range from 3 to 25 acres in size. This complex is 50 percent Clarion soil and 40 percent Storden soil. The Clarion soil is on the ridgetops, convex swales, and lower parts of side slopes. Areas of the two soils are so intricately mixed or so small in size that it was not practical to separate them in mapping. The eroded knobs of the Storden soil can be readily identified by their lighter color. The Storden soil needs large applications of phosphorus for a number of years.

Typically, the Clarion soil has a surface layer of very dark grayish brown loam and brown loam about 8 inches thick. Plowing has mixed subsoil material into the surface layer. The subsoil is about 16 inches thick. The upper part of the subsoil is brown, friable loam; and the lower part is dark yellowish brown, friable loam. The substratum is yellowish brown and light olive brown, calcareous loam to a depth of about 63 inches.

Typically, the Storden soil has a surface layer of dark brown and brown, calcareous loam about 8 inches thick. The substratum is yellowish brown, calcareous loam to a depth of about 60 inches.

Included with these soils in mapping are small areas of Lester soils. Lester soils have less organic matter than Clarion soils and are more acid than Clarion and Storden soils. In some areas the Lester soils require lime; most of these areas are in Grant Township. Also included are small areas of Salida soils, which are droughty, and areas of Okoboji, Rolfe, and Webster soils in depressions and swales that need drainage. Included soils make up about 10 percent of the map unit.

The Clarion and Storden soils have high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is generally good, but surface crusting is a problem after heavy rains. Clarion soils are typically slightly acid or neutral in the surface layer. Storden soils are typically calcareous and mildly alkaline. The Clarion soil contains about 3 percent organic matter in the surface layer, and the Storden soil contains 1 percent. The subsoil is typically very low in available phosphorus and potassium. An excess of lime in the surface layer of the Storden soil reduces the effect of fertilizer and herbicides on crops.

Most areas of these soils are cultivated. These soils are moderately suited to corn, soybeans, and other cultivated crops and to small grains. These soils are well suited to hay and pasture. These soils are moderately suited to use for most sanitary facilities and building sites.

If these soils are cultivated there is a hazard of further erosion. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Contouring and terracing are difficult because of the undulating topography and short slopes, but most areas are suited to these practices. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and increases water infiltration.

If these soils are used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This complex is in capability subclass IIIe.

638D2—Clarion-Storden loams, 9 to 14 percent slopes, moderately eroded. This complex consists of strongly sloping, well drained soils on knobs, ridgetops and side slopes of the uplands. Slopes are typically

short. Individual areas are irregular in shape and range from 3 to 40 acres in size. This complex contains 50 percent Clarion soil and 40 percent Storden soil. The Clarion soil is on the ridgetops, convex swales, and lower parts of side slopes. The Storden soil is on the more sloping convex knobs and upper parts of side slopes. Areas of the two soils are so intricately mixed or so small in size that it was not practical to separate them in mapping. The eroded knobs of the Storden soil can be readily identified by their lighter color. The Storden soil needs large applications of phosphorus.

Typically, the Clarion soil has a surface layer of very dark grayish brown loam about 8 inches thick. Plowing has mixed subsoil material into the surface layer. The subsoil is about 16 inches thick. The upper part of the subsoil is brown, friable loam; and the lower part is dark yellowish brown, friable loam. The substratum is yellowish brown and light olive brown, calcareous loam to a depth of about 63 inches.

Typically, the Storden soil has a surface layer of mixed dark brown and brown, calcareous loam about 8 inches thick. The substratum is yellowish brown, friable, calcareous loam to a depth of about 60 inches.

Included with these soils in mapping are small areas of Lester soils, which have less organic matter than Clarion soils and are more acid than Clarion and Storden soils. In some areas the Lester soils require lime; most of these areas are in Grant Township. Also included are small areas of Salida soils, which are droughty, and Okoboji, Rolfe, and Webster soils in depressions and swales that need drainage. Inclusions make up about 10 percent of the map unit.

The Clarion and Storden soils have high available water capacity. Permeability is moderate. Surface runoff is rapid. Tilth is typically good, but surface crusting is a problem after heavy rains. Clarion soils are typically slightly acid or neutral in the surface layer. Storden soils are typically calcareous and mildly alkaline. The Clarion soil contains about 3 percent organic matter in the surface layer, and the Storden soil contains 1 percent. The subsoil is typically very low in available phosphorus and potassium. An excess of lime in the surface layer of the Storden soil affects crop response to fertilizer and herbicides.

Most areas of these soils are cultivated. These soils are moderately suited to corn, soybeans, and other cultivated crops and to small grains. These soils are well suited to hay and pasture. These soils are moderately suited to use for most sanitary facilities and building sites.

If these soils are cultivated there is a hazard of further erosion damage. Conservation tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Contouring and terracing are difficult because of the undulating topography and short slopes, but most areas are suited to these practices. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, reduces crusting, and increases water infiltration.

If these soils are used for pasture and hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This complex is in capability subclass IIIe.

651—Faxon silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in upland drainageways and on first bottoms of streams. Slopes are mostly concave. This soil is subject to flooding on first bottoms and low benches. Individual areas are generally long and narrow and range from 3 to 50 acres.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 15 inches thick. The subsoil is about 9 inches thick. It is light brownish gray and very dark grayish brown, friable silty clay loam in the upper part and olive gray, friable loam in the lower part. The substratum is light brownish gray, very friable sandy loam to a depth of 36 inches. Below 36 inches is hard, shattered, level-bedded limestone bedrock.

Included with this soil in mapping are some small areas of Palms soils in depressional areas in drainageways. These areas make up less than 5 percent of the map unit.

This Faxon soil has low or moderate available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is worked when wet. Shrink-swell potential is high in the surface layer. Reaction is neutral to mildly alkaline, and effervescence is none to slight. The surface layer contains about 6 percent organic matter. The subsoil is generally very low in available phosphorus and potassium.

Most areas of this soil are not artificially drained and are used for pasture and hay. If artificially drained, this soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

Wetness limits crop production. Open ditch drainage and subsurface drainage are difficult because of the underlying limestone bedrock.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

695—Tilfer silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on stream benches, in upland drainageways, and in a few places

on first bottoms of streams. Slopes are typically long. This soil is subject to flooding on low benches and stream bottoms. Individual areas range from 2 to 40 acres.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is 9 inches thick and is black silty clay loam in the upper part and black clay loam in the lower part. The subsoil extends to a depth of 29 inches. It is light olive gray, friable loam in the upper part and light olive gray, friable silty clay loam in the lower part. The substratum is light olive gray gravelly sand about 3 inches thick. Hard, shattered limestone bedrock is at a depth of 32 inches. In places, depth to limestone is 40 to 50 inches. A few places have a mucky silt loam surface layer.

This Tilfer soil has low or moderate available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is tilled when wet. Shrink-swell potential is moderate. The root zone is limited by the bedrock. This soil is mildly alkaline or moderately alkaline and does not need lime. The surface layer contains about 6 percent organic matter. The subsoil is very low in available phosphorus and potassium. In many places available iron is not sufficient for soybeans. An excess of lime reduces the effect of fertilizer and herbicides on crops.

Most areas of this soil are not artificially drained and are used for pasture and hay. If artificially drained, this soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

Wetness limits crop production. Open ditch and subsurface drainage are difficult because of the hard shattered limestone substratum. Iron chlorosis and damage from herbicide carry-over are common in soybeans on this soil. Proper selection and use of soybean varieties, herbicides, and fertilizer minimize these problems. Returning crop residue or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

706—Cerlin silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained and moderately well drained soil is on broad ridge crests. Individual areas range from 3 to 15 acres.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark brown silt loam about 6 inches thick. The subsoil extends to a depth of 63 inches. The upper part of the subsoil is brown, grayish brown, and olive brown, firm clay loam; and the lower part is brown and gray, very firm silty clay. The substratum is gray silty clay to a depth of about 90 inches.

This Cerlin soil has high available water capacity. Permeability is moderate in the upper part of the subsoil and very slow in the lower part and the substratum. Surface runoff is slow. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if this soil is tilled when wet. This soil is typically acid in the surface layer if it has not been limed during the past 5 years. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for most sanitary facilities and building sites.

If this soil is cultivated, wetness delays fieldwork in wet seasons. Because of the very slow permeability of the lower part of the subsoil, subsurface drainage may not be satisfactory in all areas. Drainage lines should be spaced more closely than in other soils that have less clay and if possible should be placed above the very firm, fine textured part of the subsoil. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

706B—Cerlin silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained and moderately well drained soil is on long, smooth, slightly convex crests and sides of ridges on uplands. Individual areas range from 2 to 20 acres.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark brown silt loam about 4 inches thick. The subsoil extends to a depth of 55 inches. The upper part of the subsoil is brown and olive brown, friable silty clay loam; the middle part is olive brown, firm silty clay; and the lower part is gray, very firm silty clay. The substratum is gray silty clay to a depth of about 90 inches.

Included with this soil in mapping are small areas of severely eroded soils in which the clayey subsoil is near or at the surface. This subsoil is very infertile, is difficult to work, and compacts easily. These areas make up less than 10 percent of the map unit.

This Cerlin soil has high available water capacity. Permeability is moderate in the upper part of the subsoil and very slow in the lower part and the substratum.

Surface runoff is medium. This soil has a high seasonal water table. The surface layer becomes cloddy and puddled if this soil is tilled when wet. This soil is typically acid in the surface layer if it has not been limed during the past 5 years. The surface layer contains about 4 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for sanitary facilities and building sites.

If this soil is cultivated, there is a hazard of erosion and wetness delays fieldwork in wet seasons. The long, uniform slopes are well suited to contouring and terracing. Terrace cuts should be minimized to avoid exposing the underlying clayey subsoil. Contouring and terracing slow movement of surface water and let more of it soak into the soil. The movement of water and air is restricted in the lower part of the subsoil, so the extra water complicates drainage, especially in wet years. Because of the difficulty of providing adequate erosion control and drainage, a combination of terraces and subsurface drainage may be needed. The very slowly permeable subsoil forces care in the placement and spacing of drainage lines. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

725—Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches and in upland outwash areas. Individual areas range from 2 to 20 acres.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is brown loam about 6 inches thick. The subsoil extends to a depth of 27 inches. It is yellowish brown, friable loam in the upper part; grayish brown and yellowish brown, friable loam in the middle part; and grayish brown, friable sandy loam in the lower part. The substratum is grayish brown coarse sand to a depth of about 60 inches. In places in the uplands, the substratum is dominantly fine sand. In some places, depth to sand and gravel is about 40 inches.

This Hayfield soil has low or moderate available water capacity and is droughty in years of below-normal rainfall. The areas on stream benches are generally more droughty than the upland areas. Permeability is moderate in the loamy subsoil and rapid in the sandy substratum. Surface runoff is slow. This soil has a seasonal high water table. Tilth typically is good. This soil is generally acid in the surface layer if it has not been limed during the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is low in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and well suited to use for building sites.

Wetness delays fieldwork in some seasons. Subsurface drainage improves timeliness of fieldwork in some years, but placement of drainage lines is difficult in places because of the loose, water-bearing fine sand. Most of these places are in the uplands along wind-deposited sand ridges in the southeastern part of the county. Returning crop residue to the soil or the regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIs.

733—Calco silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains of rivers and streams. This soil is subject to flooding. Individual areas range from 3 to 100 acres.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is about 45 inches thick and is black silty clay loam in the upper part and black loam in the lower part. The substratum is dark gray sandy loam and olive gravelly sand to a depth of about 60 inches.

This Calco soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. Tilth typically is good. This soil is moderately alkaline and does not need lime. The surface layer contains about 7 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of the soil are used for pasture. Areas that are not protected from flooding are typically not artificially drained either; these areas are used for pasture or wildlife habitat. If properly drained, this soil is moderately suited to corn, soybeans, and other cultivated crops and to small gains. This soil is also moderately suited to grasses and legumes for hay and pasture. This soil is poorly suited to use for most sanitary facilities and building sites.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

755—Nicollet loam, 1 to 3 percent long slopes. This very gently sloping, somewhat poorly drained soil is on long, concave foot slopes of gently undulating uplands. Slopes are typically long and uniform. The areas have a well developed dendritic drainage network with no depressions. Individual areas of this soil are 4 acres to more than 100 acres.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is about 15 inches thick and is black loam in the upper part and very dark grayish brown loam in the lower part. The subsoil is dark grayish brown and olive brown, friable loam to a depth of 29 inches. The substratum is light olive brown, calcareous loam to a depth of about 60 inches.

This Nicollet soil has high available water capacity. Permeability is moderate. Surface runoff is slow. This soil has a seasonal high water table. Tilth is generally good. This soil is neutral or slightly acid and seldom needs lime. The surface layer contains about 5 percent organic matter. The subsoil is generally very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is moderately suited to use for sanitary facilities and building sites.

This soil is susceptible to slight wetness in rainy seasons. Subsurface drainage improves timeliness of tillage operations. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Because this soil is in large areas on long uniform slopes, more specialized management and higher yields are possible than on Nicollet soils having short slopes.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

777—Wapsie loam, 0 to 2 percent slopes. This nearly level, well drained soil is mostly on stream benches. Some areas are in the uplands. Individual areas range from 2 to about 40 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is brown, friable loam; the middle part is dark yellowish brown, friable loam; and the lower part is dark brown, very friable sandy loam. The substratum is yellowish brown loamy sand and gravelly sand to a depth of about 72 inches.

Included with this soil in mapping on slightly higher areas are small areas of Flagler soils, which are more droughty. These areas make up less than 5 percent of the map unit.

This Wapsie soil has low or moderate available water capacity and is droughty in years of normal or below-normal rainfall. Permeability is moderate in the loamy subsoil and very rapid in the sandy substratum. Surface runoff is slow. This soil has good tilth. Reaction is typically medium acid to neutral in the surface layer and medium acid or strongly acid in the subsoil. The soil is generally acid in the plow layer if it has not been limed in the last 5 years. The plow layer contains about 2 percent organic matter. The subsoil is very low in available phosphorous and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and well suited to use for building sites.

Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low or moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIs.

777B—Wapsie loam, 2 to 5 percent slopes. This gently sloping, well drained soil is mostly on stream benches. Some areas are in the uplands. Individual areas are regular in shape and range from 2 to about 25 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is brown, friable loam; the middle part is dark yellowish brown, friable loam; and the lower part is dark brown, very friable sandy loam. The substratum is brown gravelly loamy sand to a depth of about 60 inches.

Included with this soil in mapping are small areas of Dickinson and Flagler soils, which are more droughty. These areas make up less than 10 percent of the map unit.

This Wapsie soil has low or moderate available water capacity and is droughty in years of normal or below normal rainfall. Permeability is moderate in the loamy

subsoil and very rapid in the sandy substratum. Surface runoff is medium. This soil has good tilth. Reaction is typically medium acid to neutral in the surface layer and medium acid or strongly acid in the subsoil. This soil is generally acid in the plow layer if it has not been limed in the past 5 years. The surface layer contains about 2 percent organic matter. The subsoil is very low in available phosphorous and potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and well suited to use for building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Terrace cuts should be minimized to avoid exposing sandy and gravelly material. Pasture or hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low or moderate available water capacity Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

777C2—Wapsie loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is mostly on stream benches. Some areas are in the uplands. Individual areas are elongated in shape and range from 2 to about 10 acres in size.

Typically, the surface layer is a very dark grayish brown loam about 8 inches thick. Brown loam from the subsoil has been mixed into the surface layer. The subsoil is about 20 inches thick. The upper part of the subsoil is brown, friable loam; the middle part is dark yellowish brown, friable loam; and the lower part is dark brown, very friable sandy loam. The substratum is yellowish brown loamy sand and gravelly sand to a depth of about 60 inches.

Included with this soil in mapping are areas of Dickinson and Flagler soils, which are more droughty. These areas make up less than 5 percent of the map unit.

This Wapsie soil has low or moderate available water capacity and is droughty. Permeability is moderate in the loamy subsoil and very rapid in the sandy substratum. Surface runoff is medium. This soil has good tilth. Reaction is typically medium acid to neutral in the surface layer and medium acid or strongly acid in the subsoil. The soil is generally acid in the plow layer if it has not been limed in the last 5 years. The surface layer contains about 1 percent organic matter. The subsoil is very low in available phosphorous and potassium.

Many areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is well suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and well suited to use for building sites.

If this soil is cultivated there is a hazard of erosion. Conservation tillage, terraces, winter cover crops, and grassed waterways help to prevent soil loss. Terrace cuts should be minimized to avoid exposing sandy and gravelly material. Pasture and hay also control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Pasture can easily be overstocked since the soil has only low or moderate available water capacity. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

782—Donnan loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained and moderately well drained soil is on broad ridge crests and in concave swales on the uplands. Individual areas range from 3 to 30 acres.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsoil extends to a depth of 54 inches. The upper part of the subsoil is brown, friable loam; the middle part is yellowish brown, firm clay loam; and the lower part is dark gray, very firm silty clay. The substratum is dark gray silty clay to a depth of about 60 inches.

This Donnan soil has high available water capacity. Permeability is moderate in the upper part of the subsoil and very slow in the lower part and the substratum. Surface runoff is slow. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is tilled when wet. Shrink-swell potential is high in the subsoil. This soil is typically acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and building sites.

If this soil is cultivated, wetness delays fieldwork in wet seasons. Because of the very slow permeability of the

lower part of the subsoil, subsurface drainage systems may not function satisfactorily in all areas. Drainage lines should be spaced more closely than in other soils that have less clay, and if possible, should not be placed in the very firm, fine textured subsoil. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

If this soil is used for trees, subsurface drainage may be needed to reduce seedling mortality caused by the high water table. Drainage also improves the timeliness of operations.

This soil is in capability subclass IIw.

782B—Donnan loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained and moderately well drained soil is on long, smooth, slightly convex crests and sides of ridges on uplands. Individual areas range from 2 acres to more than 40 acres.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsoil extends to a depth of 46 inches. The upper part of the subsoil is brown, friable loam; the middle part is yellowish brown and grayish brown, firm clay loam; and the lower part is dark gray, very firm silty clay. The substratum is dark gray silty clay to a depth of about 60 inches.

Included with this soil in mapping are small areas that are severely eroded. Since the topsoil has been eroded away, the very firm, clayey subsoil is near or at the surface. This subsoil is very infertile, is difficult to work, and compacts easily. These areas make up less than 5 percent of the map unit.

This Donnan soil has high available water capacity. Permeability is moderate in the upper part of the subsoil and very slow in the lower part and the substratum. Surface runoff is medium. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is tilled when wet. Shrink-swell potential is high in the subsoil. This soil is typically acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 3 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is moderately suited to corn, soybeans, and other cultivated crops and to small grains. It is also moderately suited to grasses and legumes for hay and pasture and to trees. This soil is poorly suited to use for sanitary facilities and building sites.

If this soil is cultivated, there is a hazard of erosion and wetness delays fieldwork in wet seasons. The long, uniform slopes are well suited to contouring and terracing. Terrace cuts should be minimized to avoid exposing the the underlying clayey subsoil. Contouring and terracing slow movement of surface water, however, and let more of it soak into the soil. Movement of water and air is restricted in the lower part of the subsoil, so the extra water complicates drainage, especially in wet years. Because of the difficulty of providing adequate erosion control and drainage, a combination of terraces and subsurface drainage may be needed. The very slowly permeable subsoil forces care in placement and spacing of drainage lines. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

If this soil is used for trees, subsurface drainage may be needed to reduce seedling mortality caused by the seasonal high water table. Drainage also improves timeliness of forestry operations.

This soil is in capability subclass IIe.

782C2—Donnan loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, somewhat poorly drained and moderately well drained soil is on short side slopes on uplands. Individual areas range from 2 to 20 acres, but most are smaller than 4 acres.

Typically, the surface layer is very dark brown and brown loam about 7 inches thick. The subsoil extends to a depth of 42 inches. The upper part of the subsoil is brown, friable loam; the middle part is yellowish brown and grayish brown, firm clay loam; and the lower part is dark gray, very firm silty clay. The substratum is dark gray silty clay to a depth of about 60 inches.

Included with this soil in mapping are small areas that are severely eroded. Since the topsoil has been eroded away, the very firm, clayey subsoil is near or at the surface. This subsoil is very infertile, is difficult to work, and compacts easily. These areas make up less than 10 percent of the map unit.

This Donnan soil has high available water capacity. Permeability is moderate in the upper part of the subsoil and very slow in the lower part and the substratum. Surface runoff is medium. This soil has a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is tilled when wet. Shrink-swell potential is high in the subsoil. This soil is typically acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 2 percent organic matter. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated. This soil is poorly suited to corn, soybeans, and other cultivated crops. It is moderately suited to hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and building sites. Most areas are smaller than 4 acres and

are included with adjacent soils in a corn-and-soybean cropping system; however, yields from this soil are marginal. This soil is better suited to grasses and legumes for hay, pasture, or wildlife cover.

If this soil is cultivated, erosion is a hazard. Conservation tillage and hay and pasture help to prevent erosion. Terrace cuts should be minimized to avoid exposing the underlying clayey subsoil. Borrow material from adjacent soils may be needed to construct terraces. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

If this soil is used for trees, subsurface drainage may be needed to reduce seedling mortality caused by the seasonal high water table and to improve timeliness of forestry operations.

This soil is in capability subclass IIIe.

836B—Kilkenny clay loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex knolls and shoulders on the uplands. This soil is typically slightly higher than Lester soils. Slopes are typically short. Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is very dark gray clay loam about 8 inches thick. The subsoil is about 45 inches thick. The upper part of the subsoil is dark yellowish brown, firm clay loam; the middle part is yellowish brown and dark yellowish brown, firm clay loam and silty clay loam; and the lower part is yellowish brown, dark yellowish brown, and olive gray, firm silty clay. The substratum is light brownish gray silty clay loam to a depth of about 71 inches.

Included with this soil in mapping in swales are some small wet areas of Shorewood and Minnetonka soils, which need drainage. These areas make up less than 5 percent of the map unit.

This Kilkenny soil has high available water capacity. Permeability is moderately slow. Surface runoff is medium. The surface layer becomes cloddy if the soil is tilled when wet. The high clay content increases power requirements for tillage. Timeliness of tillage operations is very important to prevent compaction and hardening of clods when the soil dries. The surface layer is typically slightly acid or medium acid if the soil has not been limed in the last 5 years. The plow layer contains about 3 percent organic matter. The subsoil is typically medium in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is well suited to cultivated crops, hay and pasture, and trees. It is poorly suited to use for most sanitary facilities and building sites.

If this soil is cultivated, it is susceptible to moderate erosion. Pasture and hay control erosion. Contouring with a moldboard plow is difficult because of the irregular topography. Conservation tillage methods such as chisel plowing on the contour are more practical and effective in controlling erosion. Terracing is also difficult because of the irregular topography. Terrace excavations may expose the heavy silty clay loam or silty clay subsoil, which is difficult to prepare for a seedbed.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

836C2—Kilkenny clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex knolls and shoulders in the uplands. This soil is typically slightly higher than Lester soils. Slopes are typically short. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is very dark grayish brown and brown clay loam about 8 inches thick. Plowing has mixed brown subsoil material into the surface layer. The subsoil is about 40 inches thick. The upper part of the subsoil is dark yellowish brown, firm clay loam; the middle part is yellowish brown and dark yellowish brown, firm silty clay loam; and the lower part is olive gray silty clay. The substratum is light brownish gray silty clay loam to a depth of about 60 inches.

Included with this soil in mapping in swales are small wet areas of Shorewood and Minnetonka soils, which need drainage. Also included are a few small areas of severely eroded soils that have a dark yellowish brown silty clay loam or silty clay surface layer. These areas require extra power for seedbed preparation. These areas make up less than 10 percent of the map unit.

This Kilkenny soil has high available water capacity. Permeability is moderately slow. Surface runoff is medium. This soil has tilth problems. Because of the high clay content, more power is needed for tillage. Timeliness of tillage operations is very important to prevent compaction and hardening of clods when the soil dries. The soil is typically slightly acid or medium acid in the surface layer if it has not been limed in the last 5 years. The plow layer contains about 2 percent organic matter. The subsoil is typically medium in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is moderately suited to cultivated crops and well suited to

hay and pasture and to trees. This soil is poorly suited to use for most sanitary facilities and building sites.

This soil is susceptible to severe erosion when cultivated. Contouring with a moldboard plow is difficult because of the irregular topography. Conservation tillage methods such as chisel plowing on the contour are more practical and effective in controlling erosion. Terracing is also difficult because of the irregular topography. Terrace excavations may expose the heavy silty clay loam or silty clay subsoil, which is difficult to cultivate. Crop rotation and pasture and hay control erosion and maintain tilth. Grassed waterways and permanent grass strips also help to control erosion and provide nesting areas for wildlife.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

855—Shorewood silty clay loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on very gently sloping knolls in the uplands. The slopes are typically short and convex. Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is very dark brown silty clay loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part of the subsoil is mottled olive brown and dark grayish brown, friable silty clay loam; the middle part is olive brown and dark grayish brown, firm silty clay; and the lower part is olive brown and mottled yellowish brown and grayish brown, firm silty clay loam. The substratum is light brownish gray and yellowish brown, calcareous clay loam to a depth of about 60 inches.

Included with this soil in mapping are some areas of Minnetonka soils in depressions that pond water and need drainage. These areas make up less than 5 percent of the map unit.

This Shorewood soil has high available water capacity. Permeability is moderately slow or slow. Surface runoff is medium. This soil has a seasonal high water table. Tilth is a problem because of the high clay content in the surface layer. The surface layer is typically slightly acid to neutral. The surface layer contains about 6 percent organic matter. The subsoil is typically very low in available phosphorus and potassium.

Most areas of this soil are used for cultivated crops. This soil is well suited to cultivated crops, hay and pasture, and trees. It is poorly suited to use for sanitary facilities and building sites.

This soil is susceptible to wetness during rainy seasons. Subsurface drainage generally improves field moisture conditions. Placing drainage lines more closely than usual may be necessary because of the high clay content of this soil. Some of the more sloping areas are susceptible to erosion when cultivated. Pasture and hay control erosion.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIw.

936—Coland-Hanlon complex, 0 to 2 percent slopes. This complex consists of nearly level, poorly drained and moderately well drained soils on flood plains of rivers and streams. Individual areas range from 10 acres to several hundred acres in size. This complex is about 50 percent Coland soil and 20 percent Hanlon soil. The Coland soil is on the slightly concave lower parts of the flood plains. The Hanlon soil is on the slightly convex natural levees adjacent to the stream channels. These soils are subject to flooding. Areas of the two soils are so intricately mixed or small in size that it was not practical to separate them in mapping.

Typically, the Coland soil has a surface layer of black clay loam about 8 inches thick. The subsurface layer is black clay loam about 34 inches thick. The substratum extends to a depth of about 60 inches and is olive gray loam in the upper part and very dark gray and dark gray loamy sand in the lower part.

Typically, the Hanlon soil has a surface layer of black fine sandy loam about 12 inches thick. The subsurface layer is about 36 inches thick and is black fine sandy loam in the upper part and very dark gray fine sandy loam in the lower part. The substratum is very dark grayish brown sandy loam to a depth of about 72 inches.

Included with these soils in mapping are some small areas along the Winnebago and Shellrock Rivers that have limestone bedrock at a depth of less than 40 inches. Also included are small areas of Calco and Tilfer soils, which have a calcareous surface layer; crops on these soils do not respond as well to fertilizer and herbicides. Included areas make up less than 5 percent of the map unit.

The Coland soil has high available water capacity, and the Hanlon soils has moderate available water capacity. Permeability is moderate in the Coland soil and moderately rapid in the Hanlon soil. Both soils have a seasonal high water table. Tilth is quite variable. These soils are neutral or slightly acid and seldom need lime. Organic matter content is typically about 7 percent in the

Coland soil and 4 percent in the Hanlon soil. The subsoil is low or very low in available phosphorus and very low in available potassium.

Most areas of these soils are used for pasture. If adequately drained and protected from flooding, these soils are moderately suited to cultivated crops and to pasture. If not protected from flooding, these soils are poorly suited to cultivated crops, hay and pasture, and trees. Undrained areas are generally left idle. The Hanlon soil is suited to trees, but trees are generally not grown on the Coland soil because of the high water table. These soils are poorly suited to use for sanitary facilities and building sites because of flooding.

These soils are susceptible to wetness caused by flooding and the high water table. Flooding is the major hazard for crop production.

In undrained areas the surface layer does not withstand trampling by grazing livestock. Stocking or grazing should be restricted during wet periods. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seedlings on the Hanlon soil may need protection from flooding.

This soil is in capability subclass IIIw.

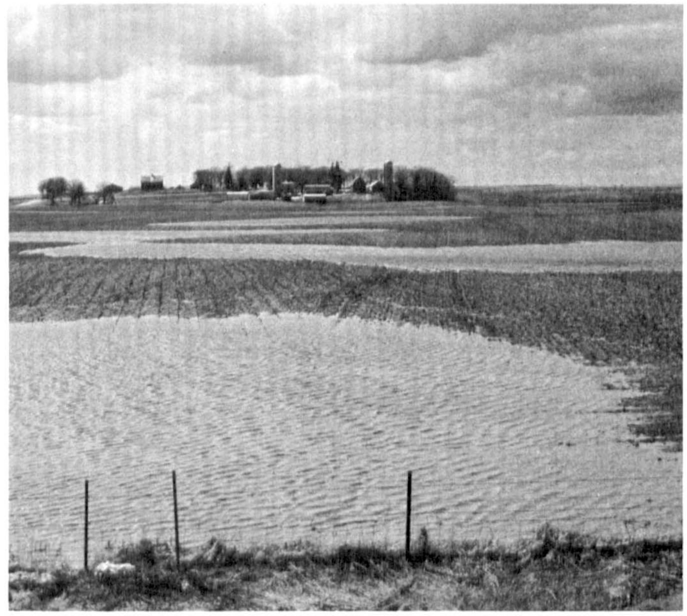

Figure 10.—Water ponds on Okoboji soils after spring rains.

956—Okoboji-Harps complex, 0 to 3 percent slopes. This complex consists of undulating, poorly drained and very poorly drained soils in the uplands. These soils are in depressions and on their adjacent rims. Individual areas range from 3 to 150 acres and contain about equal parts of Okoboji and Harps soils. Okoboji soils are in the depressions and Harps soils are on the adjacent high-lime rims. The Okoboji soil is subject to ponding (fig. 10). Areas of the two soils are so intricately mixed and so small that it was not practical to separate them in mapping.

Typically, the Okoboji soil has a surface layer of black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 21 inches thick. The subsoil is olive gray, friable silty clay loam to a depth of about 46 inches. The substratum is olive gray, calcareous silty clay loam to a depth of about 60 inches. In places, the surface layer is mucky silt loam.

Typically, the Harps soil has a surface layer of black, calcareous loam about 9 inches thick. The subsurface layer is very dark gray, calcareous loam about 7 inches thick. The subsoil is about 30 inches thick. It is light olive gray, friable, calcareous loam in the upper part and gray, friable, calcareous loam in the lower part. The substratum is gray, calcareous loam to a depth of about 65 inches.

These Okoboji and Harps soils have high available water capacity. Permeability is moderately slow in the Okoboji soil and moderate in the Harps soil. These soils have a seasonal high water table. The surface layer becomes cloddy and puddled if the soil is tilled when wet. Shrink-swell potential is high for the Okoboji soil and moderate for the Harps soil. These soils are mildly alkaline or moderately alkaline and do not need lime. The surface layer contains about 10 percent organic matter. The subsoil is very low in available phosphorus and potassium. In many places available iron is not sufficient for soybeans in the Harps soil.

Most areas of these soils are drained and cultivated. Both subsurface systems and ditches are used. These soils are moderately suited to corn, soybeans, and other cultivated crops and to grasses for hay and pasture. Undrained areas are well suited to wetland wildlife habitat. These soils are poorly suited to use for sanitary facilities and building sites.

Ponding, wetness, and excess lime limit crop production. Surface water intakes or surface drains reduce crop damage from ponding. There is a danger of early frost in fall. Iron chlorosis and damage from herbicide carry-over are common in soybeans on the Harps soil. Proper selection and use of soybean varieties, herbicides, and fertilizer minimize these problems.

If these soils are used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Most legumes are winter-killed or drown in spring if they are grown in depressions. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This complex is in capability subclass IIIw.

976—Raddle silt loam, 1 to 3 percent slopes. This very gently sloping, well drained soil is mostly on stream

benches. Some areas are on the uplands. Slopes are typically long. Individual areas range from 3 acres to more than 50 acres.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark brown silt loam about 7 inches thick. The subsoil is dark yellowish brown, friable silt loam to a depth of 54 inches. The substratum is yellowish brown loamy sand to a depth of about 65 inches.

This Raddle soil has high available water capacity. Permeability is moderate. Surface runoff is medium. Tilth is good. This soil is generally acid in the plow layer if it has not been limed during the past 5 years. The surface layer contains about 4 percent organic matter. The subsoil is low in available phosphorus and very low in available potassium.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and other cultivated crops and to small grains. It is also well suited to grasses and legumes for hay and pasture and to trees. This soil is well suited to use for sanitary facilities and building sites.

The more sloping areas of this soil are subject to erosion if cultivated. Conservation tillage and winter cover crops help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability class I.

1936—Coland-Hanlon complex, channeled, 0 to 2 percent slopes. This complex consists of nearly level, poorly drained and moderately well drained soils on flood plains dissected by meandering stream channels. Individual areas of this soil range from 10 acres to several hundred acres in size. This complex is about 50 percent Coland soil and 20 percent Hanlon soil. The Coland soil is on the slightly concave lower parts of the flood plains. The Hanlon soil is on the slightly convex natural levees adjacent to the stream channels. These soils are subject to flooding. Areas of the two soils are so intricately mixed or so small that it was not practical to separate them in mapping.

Typically, the Coland soil has a surface layer of black clay loam about 8 inches thick. The subsurface layer is black clay loam about 34 inches thick. The substratum extends to a depth of 60 inches and is olive gray loam in the upper part and very dark gray and dark gray loamy sand in the lower part.

Typically, the Hanlon soil has a surface layer of black fine sandy loam about 12 inches thick. The subsurface layer is about 36 inches thick and is black fine sandy loam in the upper part and very dark gray fine sandy loam in the lower part. The substratum is very dark grayish brown sandy loam to a depth of about 72 inches.

Included with these soils in mapping along the Winnebago and Shellrock Rivers are small areas that have limestone bedrock at a depth of less than 40 inches. These areas make up less than 5 percent of the map unit.

The Coland soil has high available water capacity, and the Hanlon soil has moderate available water capacity. Permeability is moderate in the Coland soil and moderately rapid in the Hanlon soil. Both soils have a seasonal high water table. Tilth is quite variable. These soils are neutral or slightly acid and seldom need lime. Organic matter content is typically about 7 percent in the Coland soil and 4 percent in the Hanlon soil. The subsoil is low or very low in available phosphorus and very low in available potassium.

Most areas of these soils are used for pasture. These soils are poorly suited to cultivated crops. They are moderately suited to hay and pasture if drained. Undrained areas generally are left idle. The Hanlon soil is moderately suited to trees, but trees are generally not grown on the Coland soil because of the high water table. These soils are poorly suited to use for sanitary facilities and building sites because of the flooding.

Meandering of stream channels and flooding are the main hazards to crop production. Wetness is caused by flooding and the high water table. These soils have great variations in texture, organic matter content, fertility, and drainage needs.

The surface layer of these soils does not withstand trampling by grazing livestock. Stocking or grazing should be restricted during wet periods. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Tree seedlings on the Hanlon soil may need protection from flooding.

This complex is in capability subclass Vw.

5010—Pits, sand and gravel. These pits have been surface mined for sand and gravel and are 4 feet to more than 30 feet deep. The pits are irregular in shape and range from 2 acres to about 80 acres. Some of the pits contain water generally less than 3 feet deep.

Most of these pits have spoil piles within the mined area. The spoil ranges from loam to gravelly loamy sand in texture. In some places the spoil has been leveled or smoothed; in other areas the spoil is very irregular and very uneven. These areas are reasonably easy to vegetate to grasses or trees. Cottonwood trees are common in abandoned areas. The reaction of the pits and spoil ranges from medium acid to mildly alkaline.

These areas are well suited to wildlife habitat. Revegetated leveled areas have some potential for pasture or forage crops. Very low fertility and droughtiness limit production of cultivated crops.

These areas are generally suitable for building sites but are limited for on-site waste disposal because of

possible contamination of ground water. In some pits wetness limits use for building sites.

These areas have not been placed in a capability subclass.

5030—Pits, limestone quarry. These pits are 10 to 50 feet or more deep. Piles of spoil a few feet to more than 30 feet high are in and surround the mined areas. The pits are irregular in shape and range from a few acres in size to as much as 200 acres. Some of the pits contain water from a few to many feet deep and have nearly vertical sidewalls. The pits result from quarrying of limestone primarily for cement processing, road building, and agricultural liming (fig. 11). The pits with water are pumped dry during quarrying and often are allowed to refill with water when not in use.

The spoil surrounding the pits is variable in texture and contains varying amounts of limestone fragments. The spoil is generally loamy alluvial sediment, loam glacial till, or a mixture of the two. North of Mason City some quarries have been filled with caustic waste spoil from the cement making process. This material is fine grained, has pH above 8.0, and can burn the skin. It supports very little vegetation.

In most places spoil has not been leveled or smoothed and is very uneven. The reaction of the excavated spoil ranges from slightly acid to moderately alkaline. Vacated quarries and spoil piles generally become vegetated with cottonwood trees and grass over a period of time. They are difficult to revegetate without leveling.

Figure 11.—This open pit mine provides limestone for cement.

These areas are well suited to wildlife habitat. The quarries that contain water will support fish, but because of the steep sidewalls and variable water depth they may be dangerous for recreation. Each site would need investigation to determine its safety. Areas with trees provide good woodland wildlife habitat, especially for deer.

These areas are generally poorly suited to use for building sites and onsite waste disposal because of depth to limestone.

These areas are not placed in a capability subclass.

5040—Orthents, loamy. These soils have been leveled, reshaped, or relocated by industrial, highway, or residential construction. The original soils have been changed to the extent that they are no longer recognizable. In most places the landscape has also been altered. Individual areas range from 5 to 25 acres in size.

The soil material is dominantly loam and clay loam. In some places, the whole profile has been removed and the present surface is exposed calcareous loam glacial till.

Included in mapping are some areas of fill where cement, bricks, and trash were covered with soil material and then compacted and leveled. These areas are now used as building sites, railroad yards, and highways.

Most areas are vegetated with grass and remain idle or are covered with parking lots and buildings.

Erosion is the main hazard in the new cut and fill areas. On-site investigation is needed before any engineering or agricultural decisions can be made about these areas because soil and physical conditions are variable.

These soils are not placed in a capability subclass.

5060—Pits, clay. This unit consists of areas that have been mined for shale. The shale is used primarily for making cement and manufacturing brick and tile. In some places there are permanent or intermittent ponds less than 3 feet deep. Pumping is required to lower the water level during mining.

Most of these pits support little vegetation. Areas of fill material around the permanent ponds have been developed for housing. Cracking and uneven settlement of paved streets is apparent in these areas. Wetness especially limits use for houses with basements. A few houses along Lake Conotoma have boat ramps at their basements.

These areas have not been placed in a capability subclass.

prime farmland

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. The soil

quality, growing season, and moisture supply are suitable for economically producing sustained high yields of crops if the land is treated and managed using acceptable farming methods. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment. Prime farmland is of major importance in satisfying the nation's short- and long-term needs for food and fiber. The supply of high quality farmland is limited, and it should be used with wisdom and foresight.

Prime farmland must either be currently used for producing food or fiber or be available for this use. It may be in crops, pasture, timber, or other uses except urban or built-up land or water areas. Urban or built-up land is any contiguous area 10 acres or more in size that is used for residences, industrial sites, commercial sites, construction sites, institutional sites, public administrative sites, railroad yards, small parks, cemeteries, airports, golf courses, sanitary landfills, sewage treatment plants, water control structures and spillways, shooting ranges, and so forth.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. Temperature and growing season are favorable. It has acceptable reaction and has few or no rocks, and it is permeable to water and air. Prime farmland is not excessively erodible. It is not saturated with water for long periods and is not frequently flooded during the growing season. Slope ranges mainly from 0 to 6 percent.

About 275,000 acres, nearly 75 percent, of Cerro Gordo County meets the soil requirements for prime farmland. Areas are throughout the county. Approximately 250,000 acres of this prime farmland is used for crops. Crops grown on this land, mainly corn and soybeans, account for an estimated two-thirds of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, more droughty, and more difficult to cultivate and are usually less productive.

The soils in the following list are prime farmland except where used for urban or built-up land. Special criteria are indicated by notes.

27B—Terril loam, 2 to 5 percent slopes
29—Clarion-Nicollet loam, 1 to 3 percent slopes
55—Nicollet loam, 1 to 3 percent slopes
83—Kenyon loam, 0 to 2 percent slopes
83B—Kenyon loam, 2 to 5 percent slopes
84—Clyde silty clay loam, 0 to 2 percent slopes [1,2]
95—Harps loam, 1 to 3 percent slopes [1]
107—Webster silty clay loam, 0 to 2 percent slopes [1]
135—Coland clay loam, 0 to 2 percent slopes [1]
138—Clarion loam, 0 to 2 percent slopes
138B—Clarion loam, 2 to 5 percent slopes
151—Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes [1]
152—Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes [1]
153—Shandep clay loam, 0 to 1 percent slopes [1,2]
169B—Clarion loam, 2 to 5 percent long slopes
171—Bassett loam, 0 to 2 percent slopes
171B—Bassett loam, 2 to 5 percent slopes
173—Hoopeston fine sandy loam, 1 to 3 percent slopes
174—Bolan loam, 0 to 2 percent slopes
174B—Bolan loam, 2 to 5 percent slopes
175—Dickinson fine sandy loam, 0 to 2 percent slopes
175B—Dickinson fine sandy loam, 2 to 5 percent slopes
177—Saude loam, 0 to 2 percent slopes
177B—Saude loam, 2 to 5 percent slopes
178—Waukee loam, 0 to 2 percent slopes
178B—Waukee loam, 2 to 5 percent slopes
184—Klinger silty clay loam, 1 to 3 percent slopes
188—Kensett loam, 0 to 2 percent slopes
198B—Floyd loam, 1 to 4 percent slopes
201B—Coland-Terril complex, 1 to 4 percent slopes [1,2]
213—Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes
213B—Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
214—Rockton loam, 20 to 30 inches to limestone, 0 to 2 percent slopes
214B—Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes
216B—Ripon silt loam, 20 to 30 inches to limestone, 1 to 5 percent slopes
217—Ripon silt loam, 30 to 40 inches to limestone, 0 to 2 percent slopes
217B—Ripon silt loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
225—Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
226—Lawler loam, 32 to 40 inches to sand, 0 to 2 percent slopes
236B—Lester loam, 2 to 5 percent slopes
325—Le Sueur loam, 1 to 3 percent slopes
329—Webster-Nicollet complex, 1 to 3 percent slopes [1]
335—Harcot loam, 0 to 2 percent slopes [1]
377—Dinsdale silty clay loam, 0 to 2 percent slopes
377B—Dinsdale silty clay loam, 2 to 5 percent slopes
382—Maxfield silty clay loam, 0 to 2 percent slopes [1]
391B—Clyde-Floyd complex, 1 to 4 percent slopes [1,2]
398—Tripoli silty clay loam, 0 to 2 percent slopes [1]
399—Readlyn loam, 1 to 3 percent slopes
407B—Schley loam, 1 to 4 percent slopes [1]
444—Jacwin silty clay loam, 1 to 3 percent slopes
457—Du Page silt loam, 0 to 2 percent slopes
471—Oran loam, 1 to 3 percent slopes [1]
507—Canisteo silty clay loam, 0 to 2 percent slopes [1]
536—Hanlon fine sandy loam, 0 to 2 percent slopes
551—Calamine silty clay loam, 1 to 3 percent slopes [1]
558—Talcot clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes [1]

559—Talcot clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes [1]
583—Minnetonka silty clay loam, 0 to 2 percent slopes [1]
611—Rossfield Variant silty clay loam, 1 to 3 percent slopes
612B—Mottland loam, 2 to 5 percent slopes
613—Rossfield silt loam, 0 to 2 percent slopes
613B—Rossfield silt loam, 2 to 5 percent slopes
614B—Jacwin Variant loam, 2 to 5 percent slopes
695—Tilfer silty clay loam, 0 to 2 percent slopes [1]
706—Cerlin silt loam, 0 to 2 percent slopes
706B—Cerlin silt loam, 2 to 5 percent slopes
725—Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
733—Calco silty clay loam, 0 to 2 percent slopes [1]
755—Nicollet loam, 1 to 3 percent long slopes
777—Wapsie loam, 0 to 2 percent slopes
777B—Wapsie loam, 2 to 5 percent slopes
782—Donnan loam, 0 to 2 percent slopes
782B—Donnan loam, 2 to 5 percent slopes
836B—Kilkenny silty clay loam, 2 to 5 percent slopes
855—Shorewood silty clay loam, 1 to 3 percent slopes
936—Coland-Hanlon complex, 0 to 2 percent slopes [1]
976—Raddle silt loam, 1 to 3 percent slopes

[1] Where drained sufficiently for crops.

[2] Where the soil is flooded during the growing season no more than once in 2 years.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 306,245 acres, or 83 percent, of Cerro Gordo County is used for crops; about 26,824 acres, or 7 percent, is used for pasture; and 3,507 acres, or less than 1 percent, is used for timber. Corn, soybeans, oats, and legume-grass hay are the main farm crops. Most of the permanent pasture in the county is bluegrass and grasses that are tolerant of excessive wetness. Some areas of pasture have been renovated, and birdsfoot trefoil or crownvetch has been introduced. Grass-legume mixtures, such as alfalfa and bromegrass, are also used for pasture.

Many soils are subject to water erosion. The major soils that need erosion control are Bassett, Clarion, Dinsdale, Donnan, Cerlin, Kenyon, Kilkenny, Lester, Rockton, Storden, Saude, and Wapsie soils. Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a low-fertility subsoil, such as Bassett and Kenyon soils, and on soils with a layer in or below the subsoil that limits the depth of the root zone. Such layers include bedrock as in Rockton, Ripon, and Sogn soils. Erosion also reduces productivity on soils that tend to be droughty, such as Bolan and Sparta soils. Second, soil erosion on farmland results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves quality of water for municipal use, for recreation, and for fish and wildlife.

Preparing a good seedbed and tilling are difficult on soils that are severely eroded because the original friable surface layer has been eroded away. The silty clay loam subsoil exposed on the surface in severely eroded Jacwin soils becomes hard and cloddy if worked when wet.

Erosion control practices provide protective surface cover, reduce runoff, and increase water infiltration. A cropping system that keeps a plant cover on the surface for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land and also provide

nitrogen and improve tilth for the following crop. Grassed waterways are needed to control gullying in watercourses.

Terraces and diversions reduce the length of slopes and reduce runoff and erosion. They are most practical on deep, well drained soils that have long, uniform slopes. Many of the Bassett, Dinsdale, and Kenyon soils are well suited to terracing. Other soils are less suitable for terracing and diversions because of irregular slopes, steepness, or bedrock at a depth of less than 40 inches. Bolan and Sparta soils, for example, have short, irregular slopes and coarse texture. On these soils, cropping systems that provide substantial plant cover and minimum tillage are effective in reducing erosion.

Wind erosion is a hazard on the sandy Sparta soils and the organic Palms and Houghton soils. Maintaining plant cover, surface mulch, or a rough surface through proper tillage minimizes wind erosion on these soils. Windbreaks of adapted shrubs, such as Tatarian honeysuckle or autumn-olive, are effective in reducing wind erosion on the organic soils.

Dickinson, Flagler, Salida, and Sparta soils are generally subject to erosion by both wind and water. Cover crops, minimum tillage, and mechanical control of runoff in sloping areas help to reduce erosion.

In this county fall plowing increases the hazard of wind erosion if the soils are not protected by cover crops, windbreaks, or snow. Fall plowing also increases the hazard of erosion by snowmelt early in spring.

Wetness is a major problem in many areas in Cerro Gordo County. Poorly drained and somewhat poorly drained soils make up more than 30 percent of the county. Most areas of permanent bluegrass pasture are not cultivated because they are too wet. Each year more land is drained for crops. Okoboji, Palms, Tilfer, and Faxon soils are the main ones remaining in pasture that need drainage.

The design of both surface and subsurface drainage systems varies with the kind of soil. Most somewhat poorly drained and poorly drained soils used intensively for row crops need a combination of surface drainage or protection from runoff from higher-lying areas. Drains have to be more closely spaced in soils with moderately slow permeability than in more permeable soils.

Organic soils oxidize and subside when their pore space is filled with air, so special drainage systems are needed to control the depth and the period of drainage in the Palms and Houghton soils. Keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year minimize oxidation and subsidence of these organic soils.

Providing adequate erosion control and providing adequate drainage conflict to some extent in Bassett and Kenyon soils. The loamy upper part of these soils is more permeable than the underlying glacial till. Water tends to move rapidly through the loamy material and then accumulate at the till contact, causing sidehill seepage during wet periods. Because of this difficulty, a combination of terraces and subsurface drains is most likely to be successful. Gully control structures and grassed waterways are used to control gullying in watercourses.

Soil fertility, in terms of available subsoil phosphorus and potassium, is low or very low in most soils in Cerro Gordo County. Most upland soils are acid in the subsoil and require applications of ground limestone to raise the pH level sufficiently for good growth of alfalfa and other crops that produce best on nearly neutral soils. The poorly drained Clyde soils and somewhat poorly drained Floyd soils are generally neutral in reaction. The soils that formed in alluvium on bottom lands are slightly acid to moderately alkaline in reaction. Alluvial soils in Cerro Gordo County are generally low or very low in available subsoil phosphorus and potassium.

The medium textured, well drained soils that developed under forest and grass, such as Bassett soils, contain about 2 to 3 percent organic matter. The medium textured soils that developed under grass, such as Kenyon and Clarion soils, contain about 3 to 4 percent organic matter. The eroded soils generally contain less than 2 percent organic matter, and the coarse textured upland soils generally contain less than 1 percent organic matter. Poorly drained upland soils, such as Calamine and Clyde soils, contain 7 to 11 percent organic matter. The very poorly drained Houghton and Palms soils, which are organic, contain more than 30 percent organic matter. Soils that are high in organic matter provide more nitrogen and have higher cation exchange capacity than soils that are low in organic matter.

Applications of lime and fertilizer should be based on the results of soil tests, needs of the intended crop, and the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and the infiltration of water into the soil. Soils with good tilth are generally high in organic matter, have granular structure, and are porous.

Many of the well drained upland soils in the county have a dark colored surface layer that is high in organic matter. Maintaining good tilth is easy on these soils. However, the surface layer of the poorly drained soils typically needs special care to maintain good tilth. Cultivating when the soil is too wet causes compaction and cloddiness.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension

agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*12*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection (fig. 12).

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Figure 12.—Trees are planted according to soil suitability for this farmstead windbreak.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water (fig. 13). Wildlife habitat can be created or improved by planting

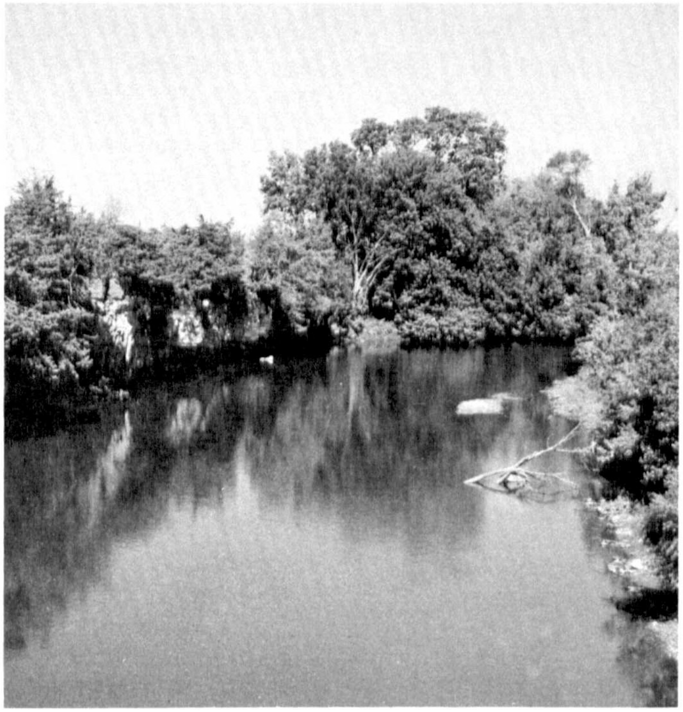

Figure 13.—The Winnebago River has entrenched itself into limestone bedrock. These areas provide wildlife habitat.

appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, soybeans, and oats.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are orchardgrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones (fig. 14). Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow

water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or

Figure 14.—Eastern white pine and Scotch pine planted near ponds provide recreation and wildlife habitat in the Lester-Webster-Nicollet association.

for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields,

sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not

favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture (*11*). These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas (fig. 15). The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

Figure 15.—Wind erosion has deposited sediment along the fence in this area of nearly level Harps soils.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*13*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*11*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*13*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Bassett series

The Bassett series consists of moderately well drained soils on crests and sides of upland ridges. These soils formed in 12 to 26 inches of moderately permeable surficial loamy sediment and the underlying moderately permeable glacial till. The native vegetation was trees and prairie grasses. Slope ranges from 0 to 25 percent.

Bassett soils are similar to Kenyon soils and are commonly near Kenyon, Oran, and Schley soils. Kenyon soils have a mollic epipedon. Oran and Schley soils are somewhat poorly drained and are on concave side slopes above or below Bassett soils.

Typical pedon of Bassett loam, 2 to 5 percent slopes, 200 feet south and 50 feet east of the northwest corner of NE1/4NE1/4 sec. 25, T. 97 N., R. 21 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) heavy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

B1—8 to 17 inches; brown (10YR 4/3) light clay loam; weak fine subangular blocky structure; friable; few very dark grayish brown (10YR 3/2) coatings on peds; slightly acid; clear smooth boundary.

IIB21t—17 to 26 inches; dark yellowish brown (10YR 4/4) heavy loam; weak fine prismatic structure parting to weak fine subangular blocky; firm; few dark brown (10YR 3/3) clay films on prisms and blocks; pebble band in the upper part of the horizon and a few small pebbles throughout; medium acid; gradual smooth boundary.

IIB22t—26 to 32 inches; yellowish brown (10YR 5/4) heavy loam; weak fine prismatic structure parting to weak medium subangular blocky; firm; nearly continuous dark grayish brown (10YR 4/2) clay films on prisms and few on blocks; few small pebbles; medium acid; gradual smooth boundary.

IIB23t—32 to 40 inches; yellowish brown (10YR 5/4) heavy loam; moderate fine prismatic structure parting to weak medium subangular blocky; firm; nearly continuous dark grayish brown (10YR 4/2) clay films on prisms; few small strong brown (7.5YR 5/6) oxide concretions; few small pebbles; medium acid; gradual smooth boundary.

IIB3—40 to 58 inches; yellowish brown (10YR 5/4) heavy loam; common fine distinct grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; firm; few small dark reddish brown (5YR 2/2) oxide concretions; few small pebbles; slightly acid; clear wavy boundary.

IIC—58 to 70 inches; pale brown (10YR 6/3) loam; common medium faint yellowish brown (10YR 5/4) mottles; massive; firm; few small strong brown (7.5YR 5/6) and dark reddish brown (5YR 2/2) oxide concretions; few small pebbles; slight effervescence; mildly alkaline.

The solum ranges from 45 to 60 inches in thickness. Carbonates are usually absent in the upper 4 feet. The surface layer typically has mollic colors to a depth of about 8 inches.

The Ap horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The A2 horizon, where present, has value of 4 and chroma of 2 or 3. The A horizon is typically loam but in places is silt loam that is high in sand. The upper part of the B horizon has hue of 10YR or 7.5YR, value of 4 or higher, and chroma of 3 or higher. It is typically heavy loam but in some pedons is light clay loam or sandy clay loam. The IIB horizon is typically strongly acid or medium acid but ranges from slightly acid to very strongly acid.

Bolan series

The Bolan series consist of well drained soils on convex side slopes of the uplands and stream benches. The upper part is moderately permeable, and the lower part is very rapidly permeable. Bolan soils formed mostly in loamy eolian material, but some formed in alluvial sediment. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Bolan soils are similar to Dickinson soils and are commonly near Dinsdale, Kenyon and Saude soils. Dickinson soils have less clay and more sand in the solum than Bolan soils. Dinsdale soils are in a fine-silty family. Kenyon soils are in a fine-loamy family. Saude soils have coarse sand and gravel in the lower part of the solum and in the IIC horizon.

Typical pedon of Bolan loam, 2 to 5 percent slopes, 2,320 feet north and 500 feet east of the southwest corner of sec. 18, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; neutral; clear smooth boundary.

A3—8 to 16 inches; dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak very fine granular; very friable; neutral; clear wavy boundary.

B1—16 to 24 inches; brown (10YR 4/3) light loam; weak medium subangular blocky structure; very friable; dark brown (10YR 3/3) coatings on peds; neutral; gradual smooth boundary.

B2—24 to 32 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; very friable; few dark brown (10YR 3/3) coatings on peds; slightly acid; gradual smooth boundary.

B3—32 to 39 inches; dark yellowish brown (10YR 4/4) light fine sandy loam; very weak medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

IIC—39 to 60 inches; dark yellowish brown (10YR 4/4) loamy fine sand with a few lenses of fine sandy loam; massive; loose; slightly acid.

The solum ranges from 30 to 48 inches in thickness. Depth to pebbles and free carbonates is typically 5 feet or more.

The A horizon has color value of 2 or 3 and chroma of 1 or 2. Texture is dominantly loam but in places is silt loam that is high in sand. The mollic epipedon may extend into the upper part of the B horizon. The B2 horizon has color value of 4 to 6 and chroma of 4 to 6. It is typically loam or fine sandy loam. The IIC horizon is

typically loamy fine sand but ranges to sand. The IIC horizon has color value of 4 or 5 and chroma of 3 to 6. Reaction throughout the profile is neutral to medium acid.

Calamine series

The Calamine series consists of poorly drained soils in swales and drainageways and on foot slopes of the uplands. These soils formed in 15 to 40 inches of moderately permeable silty sediment and the underlying very slowly permeable, calcareous shale. The native vegetation was marsh grasses, sedges, and water-tolerant forbs. Slope ranges from 1 to 3 percent.

Calamine soils are similar to Jacwin soils and are commonly near Jacwin Variant and Jacwin soils. Jacwin Variant soils are on convex slopes and are moderately well drained. Jacwin soils are above Calamine soils, contain less clay in the upper part, and are somewhat poorly drained.

Typical pedon of Calamine silty clay loam, 1 to 3 percent slopes, 480 feet west and 515 feet south of the northeast corner of SE1/4 sec. 35, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) heavy silty clay loam, black (10YR 2/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 18 inches; black (N 2/0) heavy silty clay loam; very dark gray (10YR 3/1) dry; few fine distinct olive gray (5Y 4/2) mottles in lower part of the horizon; moderate fine granular structure; friable; mildly alkaline; clear wavy boundary.

B1g—18 to 25 inches; olive gray (5Y 4/2) light silty clay; few fine distinct olive brown (2.5Y 4/4) mottles; moderate fine and very fine subangular blocky structure; firm; nearly continuous very dark gray (10YR 3/1) coatings on peds; mildly alkaline; clear wavy boundary.

IIB2tg—25 to 33 inches; olive gray (5Y 5/2) silty clay; common fine distinct olive (5Y 5/6) mottles; moderate medium prismatic structure; very firm; few very dark gray (10YR 3/1) clay films on prisms and in root channels; mildly alkaline; clear wavy boundary.

IICr—33 to 60 inches; mottled greenish gray (5GY 6/1) and olive yellow (2.5Y 6/6) silty clay shale; common fine distinct strong brown (7.5YR 5/8) mottles; massive; extremely firm; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to fine textured shale range from 20 to 40 inches. The mollic epipedon ranges from 14 to 24 inches in thickness.

The A1 horizon is black (N 2/0) or has hue of 10YR, value of 2 or 3, and chroma of 1. The A horizon is neutral to mildly alkaline. The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. The B and IIB horizons are neutral or mildly alkaline. The IIB and IIC horizons are silty clay or clay. The IIC horizon is typically mildly alkaline or moderately alkaline.

Calco series

The Calco series consists of calcareous, poorly drained, moderately permeable soils on flood plains. These soils formed in silty and loamy, calcareous alluvial sediment. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 2 percent.

Calco soils are similar to Coland soils and are commonly near Marshan and Talcot soils. Coland soils are not calcareous and have more sand in the upper 40 inches than Calco soils. Marshan soils have a thinner mollic epipedon, are not calcareous, and are underlain by sand and gravel. Talcot soils have more sand and are underlain by sand and gravel. Marshan and Talcot soils are on low stream benches.

Typical pedon of Calco silty clay loam, 0 to 2 percent slopes, 820 feet north and 200 feet east of the southwest corner of sec. 23, T. 95 N., R. 19 W., in a grass pasture:

Ap—0 to 8 inches; black (N 2/0) light silty clay loam, black (10YR 2/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few strong brown (7.5YR 5/6) oxides; slight effervescence; moderately alkaline; clear smooth boundary.

A12—8 to 16 inches; black (N 2/0) light silty clay loam, black (10YR 2/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few strong brown (7.5YR 5/6) oxides; slight effervescence; moderately alkaline; gradual smooth boundary.

A13—16 to 29 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate fine subangular blocky structure; friable; few strong brown (7.5YR 5/6) oxides; slight effervescence; mildly alkaline; clear smooth boundary.

A14—29 to 37 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate medium prismatic structure; firm; few strong brown (7.5YR 5/6) oxides; slight effervescence; mildly alkaline; clear smooth boundary.

A15—37 to 53 inches; black (N 2/0) heavy loam, very dark gray (10YR 3/1) dry; common fine faint very dark gray (N 3/0) mottles; massive; firm; few strong brown (7.5YR 5/6) oxides; mildly alkaline; clear wavy boundary.

C1g—53 to 57 inches; dark gray (5Y 4/1) sandy loam; massive; friable; few strong brown (7.5YR 5/6) oxides; mildly alkaline; clear wavy boundary.

C2—57 to 60 inches; light olive brown (2.5Y 5/4) gravelly sand; single grained; loose; few strong brown (7.5YR 5/6) oxides; about 35 percent gravel; slight effervescence; moderately alkaline.

The solum is typically silty to a depth of 36 to 40 inches. The mollic epipedon commonly is 40 to 55 inches thick.

The A horizon is typically black (N 2/0) but ranges to very dark gray (5Y 3/1) in the lower part. It is typically light to medium silty clay loam but is silt loam or loam below a depth of 36 inches in places. The A horizon is moderately alkaline and typically has slight or strong effervescence. The C horizon ranges from dark gray (5Y 4/1) to light olive brown (2.5Y 5/4) and from gravelly sand to light clay loam.

Canisteo series

The Canisteo series consists of poorly drained, moderately permeable soils on the uplands. These soils formed in calcareous glacial sediment under water-tolerant grasses. Slope ranges from 0 to 2 percent.

Canisteo soils are similar to Clyde, Harps, and Webster soils and are commonly near those soils. Clyde and Webster soils are neutral in the solum, and Harps soils are moderately alkaline in the solum.

Typical pedon of Canisteo silty clay loam, 0 to 2 percent slopes, 150 feet west and 145 feet north of the southeast corner of the NE1/4 sec. 8, T. 95 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) light silty clay loam that is high in sand, very dark gray (10YR 3/1) dry; weak medium granular structure; friable; slight effervescence; mildly alkaline; clear smooth boundary.

A12—8 to 18 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; few fine distinct dark gray (5Y 4/1) mottles in the lower 3 inches; weak fine granular structure; friable; slight effervescence; mildly alkaline; gradual smooth boundary.

B1g—18 to 25 inches; dark gray (5Y 4/1) light clay loam; few fine faint olive gray (5Y 5/2) mottles; weak fine subangular blocky structure; friable; few very dark gray (10YR 3/1) coatings on peds; slight effervescence; mildly alkaline; clear smooth boundary.

B2g—25 to 36 inches; olive gray (5Y 5/2) loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual smooth boundary.

C1g—36 to 42 inches; olive gray (5Y 5/2) loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; common dark reddish brown (5YR 2/2) oxide concretions; slight effervescence; mildly alkaline; gradual smooth boundary.

C2g—42 to 68 inches; olive gray (5Y 5/2) stratified loam, silt loam, and sandy loam; many medium distinct yellowish red (5YR 5/8) mottles; massive; friable; strong effervescence; moderately alkaline.

The solum ranges from 20 to 36 inches in thickness. The mollic epipedon ranges from 14 to 24 inches in thickness.

The A1 horizon is black (N 2/0 or 10YR 2/1) or very dark gray (10YR 3/1) silty clay loam to clay loam. The B horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2. The B horizon typically is clay loam but in places is loam, silty clay loam, or silt loam. The solum typically is calcareous and mildly alkaline or moderately alkaline throughout. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 2 to 4. Common or many, faint to distinct mottles are present. The C horizon is typically loam or light clay loam. Stratified loam, silt loam, and sandy loam horizons are present in some pedons.

Cerlin series

The Cerlin series consists of somewhat poorly drained and moderately well drained soils on crests and sides of ridges on the uplands. These soils formed in 20 to 40 inches of moderately permeable silty sediment and the underlying very slowly permeable clayey glacial till. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

The Cerlin soils are similar to Donnan soils and are commonly near Floyd, Kenyon, and Readlyn soils. Donnan soils do not have a mollic epipedon. Floyd and Kenyon soils are not clayey in the IIB and IIC horizons. Floyd soils are on concave side slopes below Cerlin soils. Kenyon soils are on convex side slopes above Cerlin soils. Readlyn soils have less clay in the IIB and IIC horizons than Cerlin soils.

Typical pedon of Cerlin silt loam, 0 to 2 percent slopes, 800 feet west and 300 feet north of the center of sec. 1, T. 96 N., R. 21 W., in a grass pasture:

Ap—0 to 8 inches; very dark brown (10YR 2/2) heavy silt loam that is high in sand, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; black (10YR 2/1) coatings on peds; slightly acid; clear smooth boundary.

A12—8 to 14 inches; very dark brown (10YR 2/2) heavy silt loam that is high in sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; black (10YR 2/1) coatings on peds; slightly acid; gradual smooth boundary.

B1—14 to 18 inches; mottled brown (10YR 4/3) and dark grayish brown (10YR 4/2) light silty clay loam; weak fine subangular blocky structure; friable; very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) coatings on peds; slightly acid; clear wavy boundary.

B21—18 to 24 inches; olive brown (2.5Y 4/4) silty clay loam; many fine distinct light olive brown (2.5Y 5/6) and common dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable; brown (10YR 4/3) coatings on peds; slightly acid; gradual smooth boundary.

B22—24 to 31 inches; olive brown (2.5Y 4/4) clay loam; few fine distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; firm; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) coatings on peds; medium acid; abrupt smooth boundary.

IIB23t—31 to 37 inches; brown (10YR 4/3) light silty clay; weak medium prismatic structure parting to strong very fine subangular blocky; very firm; continuous dark gray (10YR 4/1) clay films on ped faces; few white (10YR 8/1) dry silt coats on peds; medium acid; gradual smooth boundary.

IIB24t—37 to 54 inches; gray (10YR 5/1) light silty clay; few fine distinct brown (10YR 4/3) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; gray (10YR 5/1) clay films on peds; slightly acid; gradual smooth boundary.

IIB3t—54 to 63 inches; gray (10YR 5/1) light silty clay; common fine distinct subangular blocky structure; very firm; discontinuous gray (10YR 5/1) clay films on peds; a few coarse sand grains; neutral; gradual smooth boundary.

IIC—63 to 90 inches; gray (5Y 5/1) light silty clay; common medium distinct olive brown (2.5Y 4/4) mottles; few strong brown (7.5YR 5/8) oxide concretions; massive; extremely firm; neutral.

The solum ranges from 45 to 80 inches in thickness. The mollic epipedon ranges from 11 to 23 inches in thickness.

The A horizon is typically silt loam or silty clay loam but ranges to loam and clay loam. The A horizon is slightly acid or medium acid. The B horizon and the upper part of the IIB horizon range from slightly acid to strongly acid. The B1 and B2 horizons have hue of 10YR and 2.5Y, value of 4 or 5, and chroma of 3 or 4. Abundance of mottles ranges from none to common. The IIB horizon typically has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1, 2, or 3.

Clarion series

The Clarion series consists of well drained, moderately permeable soils on the uplands. These soils formed in glacial till under prairie vegetation. Slope ranges from 0 to 14 percent.

Clarion soils are similar to and are commonly near Lester, Nicollet, and Storden soils. Lester soils do not have a mollic epipedon. Nicollet soils are somewhat poorly drained and are on lower, concave side slopes. Storden soils have carbonates at a shallower depth than Clarion soils.

Typical pedon of Clarion loam, 2 to 5 percent slopes, 550 feet north and 70 feet west of the southeast corner of sec. 29, T. 96 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak medium granular structure; friable; black (10YR 2/1) coatings on peds; slightly acid; clear smooth boundary.

A3—8 to 13 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 4/3) dry; weak fine granular structure; friable; very dark brown (10YR 2/2) coatings on peds; neutral; clear wavy boundary.

B21—13 to 19 inches; brown (10YR 4/3) heavy loam; weak fine subangular blocky structure; friable; a little very dark grayish brown (10YR 3/2) loam mixed through the horizon; few very dark grayish brown (10YR 3/2) coatings on peds; very few small pebbles; neutral; clear wavy boundary.

B22—19 to 26 inches; dark yellowish brown (10YR 4/4) heavy loam; weak medium subangular blocky structure; friable; few brown (10YR 4/3) coatings on peds; very few small pebbles; neutral; gradual smooth boundary.

B3—26 to 36 inches; dark yellowish brown (10YR 4/4) heavy loam; few fine faint yellowish red (5YR 4/8) mottles; weak coarse subangular blocky structure; friable; few small pebbles; very few small shale fragments; neutral; clear wavy boundary.

C—36 to 63 inches; light olive brown (2.5Y 5/4) light loam; few medium distinct grayish brown (2.5Y 5/2) mottles; massive; friable; common dark reddish brown (5YR 2/2) and few dark red (2.5YR 3/6) oxide concretions; few small shale fragments; few small pebbles; strong effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates are typically 25 to 40 inches but range from 18 to 50 inches. The mollic epipedon is typically 10 to 17 inches thick.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is typically loam but in some places is silt loam that is high in sand. The B horizon is brown (10YR 4/3) and dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/4). It is typically loam or clay loam but in some places is sandy loam. Below the plow layer the solum is typically neutral or slightly acid. The C horizon is typically light olive brown (2.5Y 5/4) or olive brown (2.5Y 4/4). It is typically loam but ranges from sandy loam to light clay loam.

Clyde series

The Clyde series consists of poorly drained soils in drainageways and at the heads of drainageways in the uplands (fig. 16). These soils formed in about 30 to 50 inches of moderately permeable silty and loamy surficial sediment and loamy glacial sediment. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Clyde soils are near and are similar to Floyd soils. Floyd soils are somewhat poorly drained and are in slightly higher areas than Clyde soils.

Typical pedon of Clyde silty clay loam, 0 to 2 percent slopes, 325 feet north and 70 feet west of the southeast corner of sec. 15, T. 96 N., R. 19 W., in a cultivated field:

Figure 16.—Large glacial boulders are concentrated in some undrained areas of Clyde soils.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate very fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 15 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; neutral; clear wavy boundary.

A3g—15 to 20 inches; mottled very dark gray (10YR 3/1) and dark grayish brown (2.5Y 4/2) silty clay loam, dark grayish brown (2.5Y 4/2) dry; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

B2g—20 to 26 inches; olive gray (5Y 5/2) light silty clay loam; weak medium subangular blocky structure; friable; common yellowish brown (10YR 5/6) and few black (5YR 2/1) oxide concretions; neutral; clear smooth boundary.

B31—26 to 33 inches; yellowish brown (10YR 5/8) sandy loam; common fine faint brown (10YR 5/3) mottles; very weak medium subangular blocky structure; very friable; few dark reddish brown (5YR 2/2) oxide concretions; estimated 5 percent small pebbles; neutral; clear smooth boundary.

IIB32g—33 to 48 inches; mottled gray (5Y 5/1) and dark gray (5Y 4/1) light clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; few small pebbles; neutral; gradual smooth boundary.

IICg—48 to 72 inches; mottled yellowish brown (10YR 5/6) and gray (5Y 6/1) heavy loam; massive; firm; few strong brown (7.5YR 5/6) oxide concretions; few small pebbles; neutral.

The solum ranges from 30 to 60 inches in thickness. Depth to carbonates ranges from 45 to 80 inches. The mollic epipedon is 18 to 24 inches thick.

The A horizon is black (N 2/0) in the upper part and black (10YR 2/1) or very dark gray (10YR 3/1) in the lower part. It is typically silty clay loam but ranges from silt loam to light clay loam. The B2 horizon ranges from

gray (10YR 4/1) to light olive gray (5Y 6/2) and light olive brown (2.5Y 5/6). The B horizon is typically silty clay loam, clay loam, or heavy loam but includes strata of sandy loam and sandy clay loam less than 6 inches thick. The IIB and IIC horizons have hue of 7.5YR to 5Y; value of 4, 5, or 6; and chroma of 1 to 6. They are sandy loam to light clay loam. Reaction is neutral or slightly acid in the most acid part of the solum.

Coland series

The Coland series consists of poorly drained, moderately permeable soils on bottom lands and in some upland drainageways. These soils formed in loamy alluvial sediment. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 2 percent.

Coland soils are similar to Calco soils and are commonly near Calco, Clyde, and Marshan soils. Calco soils are calcareous and contain less sand and more silt than Coland soils. Clyde and Marshan soils have a thinner dark colored surface layer. Clyde soils are in upland drainageways and have a substratum of glacial till. Marshan soils are on low stream benches and bottom lands and have a substratum of sand and gravel.

Typical pedon of Coland clay loam, 0 to 2 percent slopes, 333 feet south and 186 feet west of the northeast corner of sec. 35, T. 95 N., R. 21 W., in a bluegrass pasture:

A11—0 to 8 inches; black (N 2/0) light clay loam, black (10YR 2/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 16 inches; black (N 2/0) light clay loam, black (10YR 2/1) dry; moderate medium granular structure; friable; neutral; gradual smooth boundary.

A13—16 to 29 inches; black (10YR 2/1) light clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; neutral; clear smooth boundary.

AC—29 to 42 inches; black (5Y 2/1) clay loam, very dark gray (5Y 3/1) dry; few fine distinct dark brown (7.5YR 4/4) and common fine faint very dark gray (5Y 3/1) mottles; weak medium subangular blocky structure; firm; neutral; clear smooth boundary.

C1—42 to 52 inches; olive gray (5Y 5/2) heavy loam; massive; firm; neutral; abrupt smooth boundary.

C2—52 to 60 inches; very dark gray (5Y 3/1) and dark gray (5Y 4/1) loamy sand; single grained; loose; neutral.

The solum ranges from 36 to 48 inches in thickness. The mollic epipedon ranges from 40 inches to more than 60 inches in thickness.

The A horizon is typically black (N 2/0, 10YR 2/1, or 5Y 2/1) but in places is very dark gray (10YR 3/1 or 5Y 3/1) in the lower part. It is typically clay loam or silty clay loam that is high in sand but in places is heavy loam in the upper 10 inches. Reaction is neutral or slightly acid in the solum. The C horizon ranges from sandy loam to clay loam but includes thin strata ranging from light silty clay to loamy sand.

Dickinson series

The Dickinson series consists of somewhat excessively drained soils on convex side slopes of uplands and stream benches. The upper part is moderately rapidly permeable, and the lower part is rapidly permeable. These soils formed in fine sandy loam overlying loamy fine sand and sand. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Dickinson soils are similar to Bolan, Hoopeston, and Sparta soils and are commonly near those soils. Bolan soils are loam in the A horizon and the upper part of the B horizon. Hoopeston soils are somewhat poorly drained and are in slightly lower areas. Sparta soils have more sand and less clay in the solum than Dickinson soils.

Typical pedon of Dickinson fine sandy loam, 2 to 5 percent slopes, 1,320 feet north and 516 feet east of the southwest corner of sec. 32, T. 95 N., R. 19 W., in a cultivated field:

Ap—0 to 9 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A12—9 to 13 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 4/3) dry; moderate fine granular structure; friable; very dark grayish brown (10YR 3/2) coatings on peds; medium acid; clear smooth boundary.

B1—13 to 17 inches; brown (10YR 4/3) fine sandy loam; moderate fine granular structure; friable; dark brown (10YR 3/3) coatings on peds; medium acid; clear smooth boundary.

B2—17 to 31 inches; brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

B3—31 to 39 inches; dark yellowish brown (10YR 4/4) loamy fine sand; weak coarse subangular blocky structure; friable; slightly acid; gradual smooth boundary.

C—39 to 60 inches; yellowish brown (10YR 5/4) sand; single grained; loose; slightly acid.

The depth to loamy fine sand or sand ranges from 24 to 36 inches.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is typically fine sandy loam but in places is sandy loam. The A horizon is neutral to medium acid. The B2 horizon has value of 3 to 5 and chroma of 3 to 6. The upper part of the horizon is typically sandy loam or fine sandy loam grading to loamy fine sand, loamy sand, and sand in the lower part of the horizon. The B horizon is slightly acid to strongly acid.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6 and ranges from loamy fine sand to sand.

Dinsdale series

The Dinsdale series consists of well drained, moderately permeable soils on ridge crests of the uplands. These soils formed in 20 to 40 inches of loess and the underlying glacial till under prairie vegetation. Slope ranges from 0 to 5 percent.

These soils are taxadjuncts to the Dinsdale series because they lack an argillic horizon and have more sand in the B2 horizon than is typical for the Dinsdale series. These differences do not alter the usefulness or behavior of these soils.

Dinsdale soils are similar to Kenyon soils and are commonly near Klinger and Maxfield soils. Kenyon soils have more sand in the upper part of the solum than Dinsdale soils. Klinger soils are somewhat poorly drained and Maxfield soils are poorly drained; they are in lower areas than Dinsdale soils.

Typical pedon of Dinsdale silty clay loam, 0 to 2 percent slopes, 200 feet south and 55 feet east of the northwest corner of sec. 9, T. 95 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; black (10YR 2/1) light silty clay loam, very dark grayish brown (10YR 3/2) dry; cloddy parting to weak fine granular structure; friable; neutral; clear smooth boundary.

A3—8 to 17 inches; very dark grayish brown (10YR 3/2) light silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; black (10YR 2/1) and very dark brown (10YR 2/2) coatings on peds; neutral; gradual smooth boundary.

B1—17 to 27 inches; dark yellowish brown (10YR 4/4) light silty clay loam; moderate fine subangular blocky structure; friable; brown (10YR 4/3) and dark brown (10YR 3/3) coatings on peds; light gray (10YR 7/2) silt coatings, dry; medium acid; clear smooth boundary.

IIB21—27 to 34 inches; yellowish brown (10YR 5/4) heavy loam; weak medium subangular blocky structure; friable; discontinuous dark brown (10YR 3/3) coatings on peds; pebble band near surface of horizon and a few pebbles throughout; medium acid; gradual smooth boundary.

IIB22t—34 to 41 inches; yellowish brown (10YR 5/6) heavy loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; brown (10YR 4/3) coatings on prisms and blocks; few dark brown (10YR 3/3) thin patchy clay films on prisms and peds; patchy light gray (10YR 7/2) fine sand coatings, dry; few small pebbles; medium acid; gradual smooth boundary.

IIB3—41 to 50 inches; yellowish brown (10YR 5/6) heavy loam; few fine distinct grayish brown (2.5Y 5/2) and few faint strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure; firm; few dark reddish brown (5YR 2/2) oxide concretions; few pebbles; neutral; gradual smooth boundary.

IIC—50 to 60 inches; yellowish brown (10YR 5/6) heavy loam; few fine distinct grayish brown (2.5Y 5/2) mottles; few red oxide concretions; massive; firm; few pebbles; neutral; clear wavy boundary.

The thickness of solum is typically about 50 inches but ranges from 42 to 60 inches. Depth to free carbonates ranges from 45 to 65 inches.

The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2) in the upper part and very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3) in the lower part. It is typically silty clay loam but in places is silt loam. The upper part of the B horizon is dark brown (10YR 3/3), brown (10YR 4/3), and dark yellowish brown (10YR 4/4). The IIB horizon and IIC horizon are typically yellowish brown (10YR 5/6 or 10YR 5/4) loam. The solum is medium acid or strongly acid in the most acid part.

Donnan series

The Donnan series consists of somewhat poorly drained and moderately well drained soils on crests and sides of ridges in the uplands. These soils formed in 20 to 40 inches of moderately permeable surficial loamy sediment and the underlying very slowly permeable clayey glacial till. The native vegetation was trees and grasses. Slope ranges from 0 to 9 percent.

Donnan soils are similar to Cerlin soils and are commonly near Bassett, Floyd, Kenyon, and Schley soils. Cerlin soils have a mollic epipedon. Bassett, Floyd, Kenyon, and Schley soils are not clayey in the IIB and IIC horizons. Bassett and Kenyon soils are on convex side slopes above Donnan soils. Floyd and Schley soils are on concave side slopes below Donnan soils.

Typical pedon of Donnan loam, 2 to 5 percent slopes, 665 feet north and 160 feet east of the southwest corner of sec. 27, T. 97 N., R. 19 W., in a cultivated field.

Ap--0 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on peds; weak fine granular structure; friable; neutral; clear smooth boundary.

B1—7 to 14 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; few very dark grayish brown (10YR 3/2) coatings on peds; strongly acid; clear smooth boundary.

B21t—14 to 20 inches; brown (10YR 4/3) light clay loam; weak medium subangular blocky stucture; friable; sand grains coated and bridged with clay; few small pebbles; strongly acid; clear smooth boundary.

B22t—20 to 27 inches; yellowish brown (10YR 5/4) light clay loam; many fine faint grayish brown (10YR 5/2)

and few fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; thin clay films on peds; few very dark brown (10YR 2/2) oxide concretions; few small pebbles; strongly acid; clear smooth boundary.

B31t—27 to 32 inches; yellowish brown (10YR 5/4) and grayish brown (2.5Y 5/2) clay loam; weak coarse subangular blocky structure; firm; few small yellowish red (5YR 4/6) oxide concretions; few very small pebbles; strongly acid; abrupt smooth boundary.

IIB32—32 to 46 inches; dark gray (10YR 4/1) silty clay; few fine dinstinct brown (7.5YR 5/6) and dark yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure breaking to moderate fine angular blocky; very firm; few small red (2.5YR 4/6) oxide concretions; discontinuous white (10YR 8/1) silt coatings on prisms when dry; medium acid; gradual smooth boundary.

IIC—46 to 60 inches; dark gray (10YR 4/1) silty clay; few fine distinct strong brown (7.5YR 5/6) mottles; massive; very firm; medium acid.

The thickness of the solum is typically 45 to 55 inches but ranges from 40 to 80 inches. The surface layer typically has mollic colors to a depth of about 7 inches.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A horizon is typically loam but ranges to silt loam and light clay loam. The A2 horizon, where present, is dark grayish brown (10YR 4/2) loam. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. A few mottles with chroma of 2 or 1 are in the upper 10 inches of the argillic horizon. The B2t horizon is commonly light clay loam but ranges from loam to light silty clay loam that has a moderate amount of sand. The IIB32 horizon has hue of 5Y, 2.5Y, or 10YR; value of 4 to 6; and chroma of 1 or 2. It is clay or silty clay.

Du Page series

The Du Page series consists of somewhat poorly drained, moderately permeable soils on bottom lands. These soils formed in calcareous silty and loamy alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Du Page soils are commonly near Calco and Coland soils. Calco soils contain more clay and less sand than Du Page soils. Coland soils contain more clay and are leached of carbonates in the upper part of the solum. Calco and Coland soils are poorly drained and are in lower areas than Du Page soils.

Typical pedon of Du Page silt loam, 0 to 2 percent slopes, 500 feet south and 500 feet west of the northeast corner of the NW1/4 sec. 35, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) heavy silt loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; strong effervescence; mildly alkaline; clear smooth boundary.

A12—8 to 22 inches; very dark brown (10YR 2/2) heavy silt loam, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; violent effervescence; mildly alkaline; gradual smooth boundary.

A13—22 to 50 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine granular; very friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C—50 to 60 inches; very dark brown (10YR 2/2) heavy silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to moderate fine granular; violent effervescence; moderately alkaline.

Some pedons contain 2 to 8 percent hard limestone fragments.

The A1 horizon is typically very dark brown (10YR 2/2) or black (10YR 2/1) but ranges to very dark grayish brown (2.5Y 3/2) and dark brown (10YR 3/3) in the lower part. Texture is typically silt loam but ranges to loam or light clay loam. In a few pedons it has thin lenses of sandy loam. The A1 horizon is 40 to 80 inches thick. It is mildly alkaline or moderately alkaline in the upper part and moderately alkaline in the lower part. The C horizon, where present, ranges from very dark brown (10YR 2/2) to brown (10YR 4/3) and dark grayish brown (2.5Y 4/2). The C horizon ranges from fine sandy loam to silty clay loam.

Faxon series

The Faxon series consists of poorly drained, moderately permeable soils in upland drainageways and on first bottoms of streams. These soils formed in 20 to 40 inches of silty and loamy sediments overlying limestone bedrock. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 2 percent.

Faxon soils are similar to Kensett soils and are commonly near Kensett, Marshan, and Tilfer soils. Kensett soils are on convex side slopes and are somewhat poorly drained. Marshan soils are underlain by sand and gravel. Tilfer soils are calcareous through the A horizon. Marshan and Tilfer soils are in lower areas than Faxon soils.

Typical pedon of Faxon silty clay loam, 0 to 2 percent slopes, 1,100 feet south and 175 feet east of the northwest corner of sec. 20, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) silty clay loam that is high in sand, black (10YR 2/1) dry; moderate coarse granular structure parting to moderate fine granular; friable; mildly alkaline; clear smooth boundary.

A12—8 to 19 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak medium granular structure parting to moderate fine granular; friable; mildly alkaline; gradual smooth boundary.
A3—19 to 23 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; common fine distinct grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; friable; mildly alkaline; clear wavy boundary.
B1g—23 to 27 inches; mixed light brownish gray (2.5Y 6/2) and very dark grayish brown (10YR 3/2) light silty clay loam that is high in sand; weak medium subangular blocky structure; friable; mildly alkaline; clear wavy boundary.
B2g—27 to 32 inches; olive gray (5Y 5/2) heavy loam; few fine distinct light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; friable; very slight effervescence; mildly alkaline; clear smooth boundary.
IICg—32 to 36 inches; light brownish gray (5Y 6/2) heavy sandy loam; common fine distinct light olive brown (2.5Y 5/6) mottles; massive; very friable; few soft strong brown (7.5YR 5/6) accumulations; very slight effervescence; mildly alkaline; abrupt wavy boundary.
IIR—36 inches; hard shattered level-bedded limestone bedrock.

Thickness of the solum and depth to limestone bedrock are typically 24 to 36 inches but range from 20 to 40 inches. The mollic epipedon ranges from 16 to 24 inches in thickness.

The A horizon is black (N 2/0 or 10YR 2/1). The B horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. The B horizon is silty clay loam that is high in sand, clay loam, or loam. The IIC horizon has hue of 7.5YR to 5Y, value of 5 or 6, and chroma of 2 to 6. The IIC horizon ranges from gravelly sand to sandy loam. Hard fractured limestone bedrock is at a depth of 20 to 40 inches.

Flagler series

The Flagler series consists of somewhat excessively drained soils on stream benches and in upland outwash areas. The upper part is moderately rapidly permeable, and the lower part is very rapidly permeable. These soils formed in 20 to 36 inches of sandy loam and the underlying noncalcareous sandy material. The native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Flagler soils are similar to Saude soils and are commonly near Saude and Wapsie soils. Saude and Wapsie soils have more clay and less sand in the A and B horizons. Wapsie soils also have a thinner dark colored A horizon.

Typical pedon of Flagler sandy loam, 2 to 5 percent slopes, 400 feet north and 30 feet west of the center of sec. 27, T. 97 N., R. 21 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam; moderate very fine granular structure; very friable; slightly acid; abrupt smooth boundary.
A12—8 to 15 inches; very dark brown (10YR 2/2) sandy loam; moderate very fine granular structure; very friable; slightly acid; clear smooth boundary.
B2—15 to 22 inches; dark brown (10YR 3/3) sandy loam; weak fine granular structure; very friable; very dark grayish brown (10YR 3/2) coatings on peds; slightly acid; clear smooth boundary.
IIB31—22 to 28 inches; brown (10YR 4/3) loamy sand; weak fine granular structure; very friable; slightly acid; gradual smooth boundary.
IIB32—28 to 35 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine granular structure; very friable; slightly acid; gradual smooth boundary.
IIC1—35 to 41 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose; neutral; gradual smooth boundary.
IIC2—41 to 56 inches; yellowish brown (10YR 5/4) coarse sand; single grained; loose; neutral; gradual smooth boundary.
IIC3—56 to 84 inches; yellowish brown (10YR 5/4) gravelly sand; single grained; loose neutral.

Thickness of the solum is typically 24 to 40 inches but ranges from 20 to 50 inches. Depth to loamy sand and sand is typically 24 to 33 inches but ranges from 20 to 36 inches and is quite variable within short distances. The mollic epipedon is 12 to 24 inches thick.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2) sandy loam or fine sandy loam. The B2 horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 6. Clay content of the B horizon ranges from 10 to 18 percent. Sand content is typically 60 to 70 percent. The B2 horizon ranges from slightly acid to strongly acid. The IIC horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is typically loamy sand with some gravel but ranges to sand and thin strata of gravelly sand.

Floyd series

The Floyd series consists of somewhat poorly drained soils on concave foot slopes and at the heads of drainageways on the uplands. These soils formed in 30 to 45 inches of moderately permeable surficial loamy sediment and the underlying moderately permeable loamy glacial till. The native vegetation was prairie grasses. Slope ranges from 1 to 4 percent.

Floyd soils are similar to Clyde soils and are commonly near Clyde, Readlyn, and Schley soils. Clyde soils are poorly drained and are below Floyd soils on the landscape. Readlyn soils are more acid in the B and IIB horizons and less friable in the IIB horizon than Floyd soils. Readlyn soils are in slightly convex areas above Floyd soils. Schley soils do not have a mollic epipedon.

Typical pedon of Floyd loam, 1 to 4 percent slopes, 580 feet north and 50 feet west of the southeast corner of sec. 15, T. 96 N., R. 19 W., in a cultivated field;

Ap—0 to 8 inches; black (10YR 2/1) heavy loam; very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 21 inches; black (10YR 2/1) light clay loam; very dark gray (10YR 3/1) dry; moderate very fine granular structure; friable; neutral; clear wavy boundary.

B1—21 to 26 inches; light olive brown (2.5Y 4/4) light clay loam; few fine faint dark grayish brown (2.5Y 4/2) mottles; weak medium subangular blocky structure; friable; discontinuous dark grayish brown (2.5Y 4/2) coatings on peds; neutral; clear smooth boundary.

B2—26 to 32 inches; yellowish brown (10YR 5/6) light sandy clay loam; weak medium subangular blocky structure; friable; few brown (10YR 5/3) coatings on peds; few small pebbles; neutral; clear smooth boundary.

IIB3—32 to 42 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) sandy clay loam; weak medium prismatic structure parting to very weak medium subangular blocky; firm; few brown (10YR 5/3) coatings on prisms; few yellowish red (5Y 5/8) oxide concretions; few small pebbles; neutral; clear wavy boundary.

IIC—42 to 78 inches; mottled light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) heavy loam; massive; firm; few soft white (10YR 8/2) accumulations of lime; few small pebbles; strong effervescence; mildly alkaline.

The solum ranges from 40 to 60 inches in thickness. Depth to carbonates ranges from 40 to 75 inches. The mollic epipedon ranges from 16 to 24 inches in thickness.

The A horizon is typically black (10YR 2/1) but ranges to very dark gray (10YR 3/1) and very dark brown (10YR 2/2). It is typically loam but ranges from silt loam to light clay loam. The A horizon is neutral or slightly acid. The B horizon is dark grayish brown (10YR 4/2) to light olive brown (2.5Y 5/4) loam, sandy clay loam, or clay loam with strata of sandy loam. The B horizon is neutral or slightly acid. The IIC horizon ranges from strong brown (7.5YR 5/6) with common grayish mottles to light brownish gray (2.5Y 6/2) with few to common grayish mottles. It ranges from loam to sandy clay loam and light clay loam and is neutral or mildly alkaline.

Hanlon series

The Hanlon series consists of moderately well drained, moderately rapidly permeable soils on natural levees along streams. These soils formed in loamy alluvium under prairie grasses. Slope ranges from 0 to 2 percent.

Hanlon soils are commonly near Calco and Coland soils. Calco and Coland soils are poorly drained and contain more clay and less sand than Hanlon soils. Calco and Coland soils are in lower areas than Hanlon soils.

Typical pedon of Hanlon fine sandy loam, 0 to 2 percent slopes, 520 feet south and 100 feet east of the northwest corner of SW1/4 sec. 14, T. 97 N., R. 21 W., in a bluegrass pasture:

A11—0 to 12 inches; black (10YR 2/1) fine sandy loam, very dark brown (10YR 2/2) dry; moderate very fine granular structure; very friable; neutral; gradual smooth boundary.

A12—12 to 37 inches; black (10YR 2/1) fine sandy loam, very dark brown (10YR 2/2) dry; very fine granular structure; very friable; neutral; diffuse smooth boundary.

A13—37 to 48 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; neutral; abrupt wavy boundary.

C—48 to 72 inches; very dark grayish brown (10YR 3/2) sandy loam; massive; very friable; a few pebbles greater than 2 millimeters; neutral.

The solum is typically 40 to 72 inches thick. Free carbonates typically are absent above a depth of 4 feet or more. The mollic epipedon typically is 40 to 72 inches or more thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is typically fine sandy loam but in some pedons is sandy loam. The B horizon, where present, has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. The B horizon is typically sandy loam. The solum is typically neutral or slightly acid. The C horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2. It ranges from sandy loam to loam.

Harcot series

The Harcot series consists of poorly drained soils on stream benches and outwash plains. These soils formed in 24 to 40 inches of moderately permeable, calcareous loamy alluvial sediment over very rapidly permeable sandy material. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Harcot soils are similar to Talcot soils and are commonly near Marshan and Talcot soils. Marshan soils are neutral or slightly acid, and Talcot soils are mildly alkaline.

Typical pedon of Harcot loam, 0 to 2 percent slopes, 100 feet west and 250 feet south of the northeast corner of the SE1/4 sec. 4, T. 97 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) loam, black (10YR 2/1) dry; weak fine and very fine granular structure;

friable; violent effervescence; moderately alkaline; clear smooth boundary.

A12ca—8 to 22 inches; black (N 2/0) heavy loam, black (10YR 2/1) dry; moderate fine granular structure; friable; violent effervescence; moderately alkaline; clear wavy boundary.

B2gca—22 to 29 inches; light olive gray (5Y 6/2) loam; weak medium subangular blocky structure; friable; very dark gray (10YR 3/1) coatings on peds; few small strong brown (7.5YR 5/8) oxide concretions; violent effervescence; moderately alkaline; clear wavy boundary.

B3g—29 to 33 inches; light olive gray (5Y 6/2) loam; common fine distinct yellowish brown (10YR 5/6) mottles; very weak medium subangular blocky structure; friable; few dark reddish brown (5YR 2/2) oxide concretions; strong effervescence; moderately alkaline; clear smooth boundary.

IICg—33 to 60 inches; light brownish gray (2.5Y 6/2) gravelly sand; common fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; slight effervescence; moderately alkaline.

Thickness of the solum and depth to sand and gravel are typically 24 to 40 inches. The mollic epipedon is 10 to 24 inches thick.

The A horizon is black (N 2/0 or 10YR 2/1) or very dark gray (10YR 3/1). It is typically loam but ranges to light clay loam and silt loam that is high in sand. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is loam, light clay loam, or sandy clay loam containing 18 to 30 percent clay. The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6; and chroma of 1 to 6. It is loamy fine sand, fine sand, gravelly sand, or sand and gravel. The B3 and IIC horizons are typically mildly alkaline or moderately alkaline, but some pedons have a neutral IIC horizon.

Harps series

The Harps series consists of poorly drained, moderately permeable, strongly calcareous soils on rims and low ridges around and between depressions in the uplands. These soils formed in glacial sediment under water-tolerant grasses. Slope ranges from 1 to 3 percent.

Harps soils are similar to Canisteo soils and are commonly near Webster soils. Canisteo soils are mildly alkaline and Webster soils are neutral in the A and B horizons.

Typical pedon of Harps loam, 1 to 3 percent slopes, 180 feet east and 24 feet north of the southwest corner of sec. 6, T. 96 N., R. 21 W., in a cultivated field:

Apca—0 to 9 inches; black (10YR 2/1) loam, gray (10YR 5/1) dry; weak medium subangular blocky structure parting to weak fine granular; friable; violent effervescence; moderately alkaline; clear smooth boundary.

A3ca—9 to 16 inches; very dark gray (10YR 3/1) heavy loam, gray (10YR 5/1) dry; weak medium subangular blocky structure; friable; violent effervescence; moderately alkaline; clear wavy boundary.

B1gca—16 to 24 inches; mottled light olive gray (5Y 6/2) and dark gray (10YR 4/1) heavy loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; violent effervescence; moderately alkaline; clear wavy boundary.

B2gca—24 to 36 inches; mottled olive gray (5Y 5/2) and light olive brown (2.5Y 5/6) loam; weak medium subangular blocky structure; friable; few yellowish red (5YR 5/8) oxide concretions; few light gray (5Y 7/1) limy concretions; violent effervescence; moderately alkaline; gradual smooth boundary.

B3gca—36 to 46 inches; gray (5Y 6/1) loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; few light gray (5Y 7/1) limy concretions; violent effervescence; moderately alkaline; gradual smooth boundary.

Cg—46 to 65 inches; gray (5Y 6/1) loam; common fine prominent strong brown (7.5Y 5/6) mottles; massive; friable; a few strong brown (7.5YR 5/6) iron oxides with common fine prominent olive gray (5Y 5/2) mottles; strong effervescence; moderately alkaline.

The solum ranges from 30 to 50 inches in thickness. The mollic epipedon ranges from 10 to 16 inches in thickness.

The A1 or Ap horizon is black (10YR 2/1) or very dark gray (10YR 3/1 or N 3/0) moist and dark gray (10YR 4/1) or gray (10YR 5/1) dry. It is loam or clay loam containing 20 to 32 percent clay. The B horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 1 or 2. The B horizon is loam, light clay loam, or sandy clay loam containing 18 to 30 percent clay. The C horizon is typically loam but in places is sandy clay loam.

Hayfield series

The Hayfield series consists of somewhat poorly drained soils on stream benches and in upland outwash areas. These soils formed in 24 to 32 inches of moderately permeable loamy alluvial sediment and the underlying rapidly permeable sandy material. The native vegetation was trees and grasses. Slope ranges from 0 to 2 percent.

Hayfield soils are similar to Wapsie soils and are commonly near Lawler, Marshan, and Wapsie soils. Lawler soils have a mollic epipedon. Marshan soils are poorly drained, and Wapsie soils are well drained. Marshan soils are in lower areas than Hayfield soils. Wapsie soils are above Hayfield soils.

Typical pedon of Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes, 363 feet west

and 23 feet north of the southeast corner of the NE1/4 sec. 14, T. 97 N., R. 21 W., in a cultivated field:

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; medium acid; abrupt smooth boundary.

A2—7 to 13 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; common fine distinct brown (7.5YR 5/4) mottles; weak medium platy structure; friable; strongly acid; clear smooth boundary.

B1—13 to 17 inches; yellowish brown (10YR 5/4) loam; few fine distinct strong brown (7.5YR 5/6) and common fine faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

B2t—17 to 24 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) heavy loam; weak medium subangular blocky structure; friable; few thin patchy clay films on pores; strongly acid; clear smooth boundary.

B3t—24 to 27 inches; grayish brown (2.5Y 5/2) sandy loam; many fine and medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; sand grains bridged with clay; strongly acid; abrupt wavy boundary.

IIC—27 to 60 inches; grayish brown (10YR 5/2) coarse sand; many fine distinct strong brown (7.5YR 5/6) mottles; single grained; loose; strong brown (7.5YR 5/6) loamy sand iron bands at 37 inches and 46 inches; neutral.

The thickness of solum and depth to sand and gravel are typically 24 to 32 inches. The depth to carbonates range from 48 to 90 inches. The surface layer typically has mollic colors to a depth of about 7 inches.

The Ap horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is loam or silt loam that is high in sand. The A2 horizon matrix has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. The A horizon ranges from slightly to strongly acid. The B horizon has hue of 10YR or 2.5Y and value of 4 or 5; chroma generally is 3 or 4 but ranges from 2 to 6 in the lower part. The B horizon ranges from medium acid to very strongly acid.

Hoopeston series

The Hoopeston series consists of somewhat poorly drained soils on stream benches and in the uplands. The upper part is moderately rapidly permeable, and the lower part is rapidly permeable. These soils formed in sandy and loamy alluvial and eolian sediment. The native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Hoopeston soils are similar to Dickinson soils and are commonly near Dickinson and Lawler soils. Dickinson soils are somewhat excessively drained and are above Hoopeston soils. Lawler soils have texture contrast between the B and C horizons and contain a little more clay and a little less sand in the solum than Hoopeston soils.

Typical pedon of Hoopeston fine sandy loam, 1 to 3 percent slopes, 1,115 feet south and 50 feet east of the northwest corner of sec. 34, T. 94 N., R. 19 W., in a cultivated field:

Ap—0 to 9 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

A12—9 to 15 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; neutral; clear smooth boundary.

A3—15 to 23 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; common fine faint brown (10YR 4/3) mottles; weak fine granular structure; very friable; black (10YR 2/1) coatings on peds; neutral; clear smooth boundary.

B2—23 to 35 inches; dark grayish brown (10YR 4/2) fine sandy loam; few fine distinct yellowish brown (10YR 5/4 and 10YR 5/6) mottles; weak medium subangular blocky structure; very friable; neutral; clear smooth boundary.

C1—35 to 49 inches; grayish brown (10YR 5/2) loamy sand; many fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; mildly alkaline; clear smooth boundary.

C2—49 to 60 inches; grayish brown (2.5Y 5/2) loamy sand; few fine faint light brownish gray (2.5Y 6/2) and few fine distinct light olive brown (2.5Y 5/6) mottles; single grained; loose; mildly alkaline.

The thickness of the solum is typically 24 to 36 inches but ranges from 20 to 44 inches. The mollic epipedon ranges from 12 to 24 inches in thickness. Depth to loamy sand or sand ranges from 20 to 40 inches. Some pedons have a few pebbles below a depth of about 40 inches.

The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The B2 horizon ranges from dark grayish brown (10YR 4/2 or 2.5Y 4/2) to brown (10YR 4/3) and grayish brown (2.5Y 5/2) and has few to common mottles. The A and B horizons are commonly fine sandy loam or sandy loam. The A and B horizons range from neutral to strongly acid. The C horizon ranges from loamy sand to sand.

Houghton series

The Houghton series consists of very poorly drained, moderately permeable to moderately rapidly permeable soils in depressions on the uplands and on stream benches. These soils formed in 51 inches to more than

10 feet of organic material overlying stratified loamy mineral sediment. The native vegetation was marsh grasses and sedges. Slope is 0 to 1 percent.

Houghton soils are similar to Palms soils and are commonly near Canisteo, Harps, Okoboji, and Palms soils. Canisteo, Harps, and Okoboji soils are mineral soils, and Canisteo and Harps soils are calcareous. Palms soils are organic but have mineral sediment at a depth of 16 to 50 inches. Canisteo and Harps soils are above Houghton soils.

Typical pedon of Houghton muck, 0 to 1 percent slopes, 1,000 feet south and 210 feet west of the northeast corner of the SE1/4 sec. 1, T. 95 N., R. 22 W., in a cultivated field:

Oap—0 to 9 inches; black (N 2/0) sapric material, broken face and rubbed; weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

Oa2—9 to 16 inches; black (10YR 2/1) sapric material, broken face and rubbed; about 10 percent dark brown (7.5YR 3/2) fibers, a trace rubbed; weak medium subangular blocky structure; friable; few white (10YR 8/1) fine sand grains; neutral; clear smooth boundary.

Oa3—16 to 29 inches; black (10YR 2/1) sapric material, broken face and rubbed; about 10 percent dark brown (7.5YR 3/2) fibers, a trace rubbed; massive breaking to thick platy fragments; friable; neutral; gradual smooth boundary.

Oa4—29 to 41 inches; black (10YR 2/1) sapric material, broken face and rubbed; about 8 percent dark brown (7.5YR 3/2) fibers, a trace rubbed; massive; friable; mildly alkaline; clear wavy boundary.

Oa5—41 to 60 inches; black (10YR 2/1) sapric material, broken face and rubbed; massive; friable; few snail shells throughout, common snail shells between depths of 47 to 49 inches; slight effervescence; mildly alkaline.

The organic layers are 51 inches to more than 10 feet thick. These layers have hue of 10YR and 7.5YR or are neutral; value is 2 or 3 and chroma is 3 or less. The organic material is primarily sapric, but fibric or hemic layers are present in some pedons. Hemic layers, where present in the control section, have a combined thickness of less than 10 inches, and fibric layers total less than 5 inches in thickness. Reaction is neutral or mildly alkaline.

Jacwin series

The Jacwin series consists of somewhat poorly drained soils on low uplands and on high stream benches bordering the uplands. Jacwin soils formed in 20 to 40 inches of moderately permeable silty sediment and the underlying very slowly permeable clayey material weathered from shale. The native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

These soils in Cerro Gordo County are taxadjuncts to the Jacwin series because they are silty clay loam and silt loam in the control section and because many pedons have mottles higher in the profile than is typical for the Jacwin series. These differences do not alter the usefulness or behavior of the soils.

Jacwin soils are similar to Calamine soils and are commonly near Jacwin Variant and Calamine soils. Calamine soils are poorly drained and are below Jacwin soils. Jacwin Variant soils are moderately well drained and are in higher areas than Jacwin soils on more sloping convex crests and sides of ridges.

Typical pedon of Jacwin silty clay loam, 1 to 3 percent slopes, 634 feet north and 65 feet east of the southwest corner of the NW1/4 sec. 2, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 7 inches; black (10YR 2/1) light silty clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

A12—7 to 17 inches; black (10YR 2/1) light silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to moderate fine and very fine granular; friable; neutral; clear wavy boundary.

B2—17 to 22 inches; dark grayish brown (2.5Y 4/2) silty clay loam that is high in sand; small amount of olive yellow (2.5Y 6/6) in lower part of horizon; weak fine and very fine subangular blocky structure; friable; few very dark gray (10YR 3/1) coatings on peds; neutral; clear smooth boundary.

B31—22 to 32 inches; olive yellow (2.5Y 6/6) silt loam that is high in sand; few fine faint yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; very friable; few yellowish brown (10YR 5/4) coatings on peds; few small dark reddish brown (5YR 2/2) oxide concretions; slight effervescence; mildly alkaline; clear smooth boundary.

IIB32—32 to 48 inches; olive (5Y 5/4) silty clay; common fine distinct greenish gray (5GY 6/1) and few fine distinct yellowish brown (10YR 5/6) mottles; massive; extremely firm; strong effervescence; moderately alkaline; gradual smooth boundary.

IICr—48 to 60 inches; olive (5Y 5/4) and greenish gray (5GY 6/1) silty clay shale; massive; extremely firm; few small lime concretions; strong effervescence; moderately alkaline.

Thickness of solum is typically greater than 36 inches but ranges from 30 to 55 inches. Depth to material weathered from shale is typically 24 to 36 inches but ranges from 20 to 40 inches. Free carbonates typically are present in the lower part of the solum.

The A11 or Ap horizon is black (10YR 2/1) or very dark gray (10YR 3/1). The A12 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). Texture is typically silty clay loam but ranges to loam.

Reaction is neutral or slightly acid. The B2 horizon has hue of 2.5Y and 10YR, value of 4 or 5, and chroma of 2 to 6. It is typically silty clay loam but ranges to loam and is slightly acid to mildly alkaline. Some pedons have a thin layer of sandy loam above the fine textured IIB3 or IICr horizon. The IIB horizon formed in weathered shale and is mottled with low chroma and hue of 10YR, 2.5Y, 5Y, or 5G. The IICr horizon is calcareous, extremely firm silty clay or clay shale.

Jacwin Variant

The Jacwin Variant consists of moderately well drained soils on the uplands. These soils formed in 20 to 40 inches of moderately permeable loamy sediment and the underlying very slowly permeable, calcareous, illitic shale. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Jacwin Variant soils are similar to Calamine soils and are commonly near Calamine, Jacwin, Mottland, and Rossfield soils. Jacwin soils are somewhat poorly drained, and Calamine soils are poorly drained. Jacwin and Calamine soils are less sloping than Jacwin Variant soils and are in lower areas. Mottland and Rossfield soils are at higher elevations and have a friable arenaceous limestone IIC horizon.

Typical pedon of Jacwin Variant loam, 2 to 5 percent slopes, 800 feet east and 370 feet south of the center of sec. 3, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) heavy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; black (10YR 2/1) coatings on peds; medium acid; clear smooth boundary.

A12—8 to 16 inches; very dark grayish brown (10YR 3/2) light clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; black (10YR 2/1) and very dark brown (10YR 2/2) coatings on peds; medium acid; clear wavy boundary.

B1—16 to 21 inches; mixed brown (10YR 4/3) and very dark grayish brown (10YR 3/2) light clay loam; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

B2—21 to 28 inches; dark yellowish brown (10YR 4/4) light clay loam; weak medium subangular blocky structure; friable; brown (10YR 4/3) coatings on peds; small amount of very dark brown (10YR 2/2) organic stains in root channels; few small pebbles; neutral; clear smooth boundary.

IIB3—28 to 35 inches; light olive brown (2.5Y 5/6) heavy silty clay; moderate medium prismatic structure parting to moderate very fine prismatic; very firm; olive (5Y 5/3) coatings on prisms; mildly alkaline; clear wavy boundary.

IICr1—35 to 52 inches; light olive brown (2.5Y 5/6) heavy silty clay shale; weak medium prismatic structure; extremely firm; olive (5Y 5/3) coatings on prisms; few very dark brown (10YR 2/2) stains in root channels; few small hard lime concretions and fragments; strong effervescence; mildly alkaline; clear smooth boundary.

IICr2—52 to 60 inches; light olive (2.5Y 5/6) heavy silty clay shale; massive; extremely firm; violent effervescence; mildly alkaline.

Thickness of solum and depth to carbonates are typically 30 to 40 inches and range from 25 to 45 inches. The thickness of sediment over the material weathered from shale typically is 24 to 32 inches but ranges from 20 to 40 inches. The mollic epipedon ranges from 11 to 20 inches in thickness.

The A1 or Ap horizon typically is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The A horizon is clay loam, silty clay loam, or loam. It ranges from neutral to medium acid. The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Texture is loam, clay loam, or light silty clay loam. It is neutral or slightly acid. The IIB horizon ranges from dark yellowish brown (10YR 4/4) to olive (5Y 5/3) and olive yellow (2.5Y 6/6). The IICr horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 2 to 6. The IICr horizon is 40 to 65 percent clay and is mildly alkaline or moderately alkaline.

Kensett series

The Kensett series consists of somewhat poorly drained, moderately permeable soils on stream benches and uplands. These soils formed in 24 to 40 inches of loamy sediment over limestone bedrock. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Kensett soils are similar to Faxon soils and are commonly near Faxon, Rockton, and Tilfer soils. Faxon and Tilfer soils are poorly drained and are below Kensett soils on the landscape. Rockton soils are well drained and are usually above Kensett soils.

Typical pedon of Kensett loam, 0 to 2 percent slopes, 315 feet west and 360 feet south of the northeast corner of the NW1/4 sec. 28, T. 96 N., R. 19 W., in a bluegrass pasture:

Ap—0 to 7 inches; black (10YR 2/1) heavy loam, very dark gray (10YR 3/1) dry; moderate fine and medium granular structure; friable; abundant roots; neutral; abrupt smooth boundary.

A12—7 to 15 inches; black (10YR 2/1) heavy loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; few pebbles greater than 2 millimeters; neutral; gradual smooth boundary.

B1—15 to 21 inches; dark grayish brown (2.5Y 4/2) heavy loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak very fine subangular blocky structure parting to weak fine granular; friable; very dark grayish brown (10YR 3/2) coatings on peds; neutral; clear wavy boundary.

B2—21 to 26 inches; light olive brown (2.5Y 5/4) loam; few fine faint light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; friable; dark grayish brown (10YR 4/2) coatings on peds; common dark reddish brown (5YR 2/2) oxides; mildly alkaline; clear wavy boundary.

B3—26 to 28 inches; yellowish brown (10YR 5/6) gravelly loamy sand; single grained; loose; few dark reddish brown (5YR 2/2) oxides; few soft lime accumulations; mildly alkaline; abrupt wavy boundary.

IIR—28 inches; hard fractured limestone bedrock.

Thickness of solum and depth to hard fractured limestone are typically 28 to 36 inches but range from 24 to 40 inches. The mollic epipedon ranges from 10 to 24 inches in thickness.

The A horizon is typically black (10YR 2/1) but ranges to very dark gray (10YR 3/1) and very dark brown (10YR 2/2). It is typically loam but ranges to silty clay loam and silt loam that is high in sand. The B2 horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 to 5. Mottles range from few to many. The B horizon is typically loam but ranges from light clay loam to sandy loam. The B horizon is slightly acid to neutral in the most acid part. In some pedons a small amount of fractured limestone is interbedded with finer textured material in the lower part of the solum.

Kenyon series

The Kenyon series consists of moderately well drained soils on crests and sides of ridges on the uplands. These soils formed in 13 to 26 inches of moderately permeable surficial loamy sediment and the underlying moderately permeable loamy glacial till. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Kenyon soils are similar to Bassett and Readlyn soils and are commonly near Floyd and Readlyn soils. Floyd and Readlyn soils are somewhat poorly drained. Bassett soils do not have a mollic epipedon. Floyd soils are on convex side slopes below Kenyon soils.

Typical pedon of Kenyon loam, 2 to 5 percent slopes, 1,200 feet west and 360 feet north of the southeast corner of the SW1/4 sec. 30. T. 95 N., R. 19 W., in a cultivated field:

Ap—0 to 9 inches; black (10YR 2/1) heavy loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; firm; neutral; abrupt smooth boundary.

A12—9 to 17 inches; black (10YR 2/1) heavy loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A3—17 to 22 inches; dark brown (10YR 3/3) heavy loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; friable; very dark brown (10YR 2/2) coatings on peds; medium acid; clear smooth boundary.

IIB21—22 to 31 inches; brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; dark grayish brown (10YR 4/2) coatings on peds; very dark brown (10YR 2/2) organic coatings in pores and root channels; medium acid; clear smooth boundary.

IIB22—31 to 39 inches; dark yellowish brown (10YR 4/4) loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; grayish brown (10YR 5/2) coatings on blocks and prisms; medium acid; clear smooth boundary.

IIB3—39 to 47 inches; dark yellowish brown (10YR 4/4) loam; common fine distinct yellowish brown (10YR 5/6) and a few fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure; firm; common fine distinct reddish brown (5YR 2/2) oxides; slightly acid; abrupt wavy boundary.

IIC—47 to 60 inches; yellowish brown (10YR 5/4) loam; common medium faint grayish brown (2.5Y 5/2) and common fine faint yellowish brown (10YR 5/6) mottles; massive; firm; common white (10YR 8/1) lime accumulations; strong effervescence; mildly alkaline.

The thickness of solum and depth to free carbonates range from 45 to 66 inches. The mollic epipedon ranges from 10 to 23 inches in thickness.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). It is typically loam but ranges to silt loam that is high in sand. The A horizon is neutral to medium acid. The IIB horizon ranges from dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/8). It is typically loam but in places is light clay loam and sandy clay loam. The IIC horizon has value of 4 to 6 and chroma of 1 to 6. It ranges from loam to light clay loam and sandy clay loam. The IIC horizon is neutral or mildly alkaline. In some places there are lenses and pockets of sandy material.

Kilkenny series

The Kilkenny series consists of moderately well drained, moderately slowly permeable soils on the uplands. These soils formed in 3 to 10 feet of clayey lacustrine sediment and the underlying glacial till. The native vegetation was trees and prairie grasses. Slope ranges from 2 to 9 percent.

Kilkenny soils are similar to Lester soils and are commonly near Lester, Minnetonka, and Shorewood soils. Lester soils have less clay in the solum than Kilkenny soils. Shorewood and Minnetonka soils have a mollic epipedon, are more poorly drained, and are in lower areas than Kilkenny soils.

Typical pedon of Kilkenny clay loam, 2 to 5 percent slopes, 192 feet south and 70 feet east of the northwest

corner of the SW1/4 sec. 6, T. 97 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; very dark gray (10YR 3/1) light clay loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

B1—8 to 16 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium subangular blocky structure; firm; brown (10YR 4/3) coatings on peds; slightly acid; clear wavy boundary.

B21t—16 to 26 inches; dark yellowish brown (10YR 4/4) light clay loam; moderate fine subangular blocky structure; firm; brown (10YR 4/3) coatings on peds; common dark brown (10YR 3/3) and dark grayish brown (2.5Y 4/2) clay films on peds and in pores and root channels; few reddish brown (5YR 4/4) oxide concretions; strongly acid; gradual smooth boundary.

B22t—26 to 34 inches; yellowish brown (10YR 5/6) heavy silty clay loam; weak fine subangular blocky structure; firm; brown (10YR 4/3) coatings on peds; few thin dark grayish brown (2.5Y 4/2) clay films on peds; few dark reddish brown (5YR 2/2) and reddish brown (5YR 4/4) oxide concretions; medium acid; clear smooth boundary.

B31t—34 to 41 inches; mottled yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) silty clay; weak medium subangular blocky structure; firm; brown (10YR 4/3) and dark yellowish brown (10YR 3/4) coatings on peds; few very dark gray (10YR 3/1) clay films on peds; few dark reddish brown (5YR 3/4) and yellowish red (5YR 5/8) oxide coatings on peds; common small gray shale particles; medium acid; clear smooth boundary.

B32t—41 to 53 inches; olive gray (5Y 5/2) silty clay; weak medium prismatic structure; firm; many root channels and pores filled with black (N 2/0) clay films; common dark reddish brown (5YR 2/2) and yellowish red (5YR 5/8) oxide concretions; few thin very dark grayish brown (10YR 3/2) clay films on prisms; neutral; clear wavy boundary.

C—53 to 71 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium distinct strong brown (7.5YR 5/8) mottles; very weak prismatic structure; friable; few small dark reddish brown (5YR 2/2) and yellowish red (5YR 5/8) oxide concretions; few dark clay films; strong effervescence; mildly alkaline; clear smooth boundary.

Thickness of the solum and depth to free carbonates are typically 45 to 55 inches but range from 36 to 64 inches. The surface layer typically has mollic colors to a depth of about 8 inches.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1. It is neutral to medium acid. The A horizon is typically clay loam but ranges to heavy loam, heavy silt loam, or silty clay loam. The B1 horizon is slightly acid to strongly acid, and the B2 horizon is typically strongly acid but ranges from medium acid to very strongly acid. The B2 horizon has value of 4 or 5 and chroma of 3 to 6. The C horizon is calcareous silty clay loam, clay loam, or loam glacial till.

Klinger series

The Klinger series consists of somewhat poorly drained soils on slightly convex ridges in the uplands. These soils formed in 22 to 40 inches of moderately permeable silty loess and the underlying moderately permeable loamy glacial till. The native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Klinger soils are similar to Readlyn soils, and are commonly near Dinsdale and Maxfield soils. Readlyn soils contain more sand in the upper part of the solum than Klinger soils. Dinsdale soils are well drained and are above Klinger soils. The poorly drained Maxfield soils are downslope in broad drainageways.

Typical pedon of Klinger silty clay loam, 1 to 3 percent slopes, 920 feet west and 286 feet north of the southeast corner of sec. 4, T. 95 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; cloddy parting to weak fine granular structure; friable; slightly acid; clear smooth boundary.

A12—8 to 15 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; medium acid; gradual smooth boundary.

B1—15 to 22 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; small amount of very dark grayish brown (10YR 3/2) mixed through the horizon; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B21—22 to 30 inches; mottled dark yellowish brown (10YR 4/4) and dark grayish brown (2.5Y 4/2) silty clay loam; moderate fine subangular blocky structure; friable; discontinuous grayish brown (2.5Y 5/2) coatings on prisms and peds; few small dark reddish brown (5YR 2/2) oxide concretions; medium acid; clear smooth boundary.

IIB22—30 to 46 inches; yellowish brown (10YR 5/8) heavy loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate fine prismatic structure parting to weak medium subangular blocky; firm; nearly continuous grayish brown (10YR 5/2) coats on prisms; few dark reddish brown (5YR 2/2) oxide concretions; few small pebbles; neutral; gradual smooth boundary.

IIC1—46 to 62 inches; yellowish brown (10YR 5/8) heavy loam; common fine distinct grayish brown (2.5Y 5/2) mottles; massive; firm; few small pebbles; neutral; clear wavy boundary.

IIC2—62 to 76 inches; yellowish brown (10YR 5/8) heavy loam; common medium distinct grayish brown

(2.5Y 5/2) mottles; massive; firm; few small pebbles; strong effervescence; mildly alkaline.

Thickness of the solum is typically about 4 feet but ranges from 40 to 60 inches. Carbonates are present at a depth of about 45 to 70 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B2 horizon has value of 4 or 5 and chroma of 2 to 4. It is silty clay loam and is 28 to 35 percent clay. The A horizon and the upper part of the B horizon are slightly acid to medium acid. The IIC horizon is loam or clay loam.

Lawler series

The Lawler series consists of somewhat poorly drained soils on stream benches and in upland alluvial areas. These soils formed in 24 to 40 inches of moderately permeable loamy alluvium and the underlying rapidly permeable gravelly sand. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Lawler soils are similar to Saude soils and are commonly near Hayfield, Marshan, Saude, and Waukee soils. Hayfield soils have a thinner dark colored A horizon than Lawler soils. Marshan soils are poorly drained and are in lower areas. Saude and Waukee soils are well drained and are in higher areas.

Typical pedon of Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes, 242 feet east and 711 feet south of the northwest corner of the SW1/4 sec. 18, T. 97 N., R. 20 W., in a cultivated field:

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; friable; abundant roots; neutral; abrupt smooth boundary.

A12—8 to 16 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few soft brown (7.5YR 5/6) accumulations; neutral; clear smooth boundary.

B1—16 to 20 inches; dark grayish brown (10YR 4/2) heavy loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; very dark grayish brown (10YR 3/2) coatings on peds; neutral; clear smooth boundary.

B2—20 to 24 inches; mottled grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

B3—24 to 28 inches; mottled grayish brown (2.5Y 5/2), light olive brown (2.5Y 5/4), and light brownish gray (2.5Y 6/2) light sandy loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; very friable; dark reddish brown (5YR 2/2) oxides; neutral; abrupt wavy boundary.

IIC1—28 to 60 inches; mottled light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6) gravelly coarse sand; single grained; loose; mildly alkaline.

Thickness of the solum and depth to sand and gravel are 24 to 32 inches. Carbonates are generally absent in the solum and the upper 2 feet of the IIC horizon. The mollic epipedon ranges from 10 to 24 inches in thickness.

The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2) in the upper part and very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2) in the lower part. It is typically loam but in places is silt loam that is high in sand. It ranges from neutral to medium acid. The B2 horizon is typically loam but in places is sandy clay loam. It is neutral to medium acid. The IIC horizon ranges from loamy coarse sand to gravelly sand with 10 to 30 percent gravel. It has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 6. It is slightly acid to mildly alkaline.

Lester series

The Lester series consists of well drained, moderately permeable soils on glacial till uplands. These soils formed in calcareous glacial till under mixed hardwood forest and prairie grasses. Slopes are short and range from 2 to 25 percent.

Lester soils are similar to Clarion soils and are commonly near Clarion, Nicollet, and Storden soils. Clarion soils have a thicker dark-colored A horizon than Lester soils. Nicollet soils are somewhat poorly drained and are on slightly concave side slopes above or below Lester soils. Storden soils are less acid and less deep over carbonates.

Typical pedon of Lester loam, 2 to 5 percent slopes, 1,079 feet east and 85 feet north of the southwest corner of sec. 3, T. 97 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

B1—8 to 14 inches; brown (10YR 4/3) light clay loam; weak medium subangular blocky structure; friable; few very dark grayish brown (10YR 3/2) coatings on peds; slightly acid; gradual smooth boundary.

B2t—14 to 27 inches; dark yellowish brown (10YR 4/4) light clay loam; weak medium subangular blocky structure; friable; few dark brown (10YR 3/3) thin patchy clay films on peds; few small pebbles; medium acid; gradual smooth boundary.

B3—27 to 38 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; few small strong brown (7.5YR 5/6) oxide concretions; few small pebbles; slightly acid; gradual smooth boundary.

C1—38 to 43 inches; light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6) loam; massive; friable; few soft red (2.5YR 4/8) accumulations; few small pebbles; neutral; clear wavy boundary.

C2—43 to 60 inches; light olive brown (2.5Y 5/4) loam; massive; friable; few dark reddish brown (5YR 2/2) oxide concretions; a few soft red (2.5YR 4/8) accumulations; strong effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates typically are 30 to 40 inches but range from 20 to 48 inches. The surface layer typically has mollic colors to a depth of about 8 inches.

The Ap or A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is typically loam but in places is silt loam that is high in sand. The A2 horizon, where present, is brown (10YR 4/3) or dark grayish brown (10YR 4/2) loam. The A horizon is neutral or slightly acid. The upper part of the B horizon is brown (10YR 4/3) or dark yellowish brown (10YR 4/4). The lower part of the B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4 and is loam or clay loam. The B horizon ranges from slightly acid to strongly acid. The C horizon has hue of 2.5Y, value of 4 to 6, and chroma of 3 to 6. It is typically loam but ranges from sandy loam to light clay loam.

Le Sueur series

The Le Sueur series consists of somewhat poorly drained, moderately permeable soils on the uplands. These soils formed in calcareous glacial till under trees and grasses. Slope ranges from 1 to 3 percent.

These soils are taxadjuncts to the Le Sueur series because they lack a mollic epipedon, which is definitive for the Le Sueur series. This difference does not alter the usefulness or behavior of the soils.

Le Sueur soils are similar to Lester and Nicollet soils and are commonly near Nicollet soils. Lester soils are well drained. Nicollet soils have a thicker dark colored A horizon than Le Sueur soils.

Typical pedon of Le Sueur loam, 1 to 3 percent slopes, 75 feet south and 466 feet east of the northwest corner of the SE1/4SW1/4 sec. 6, T. 97 N., R. 21 W., in a cultivated field:

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 11 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; common fine distinct (10YR 5/6) mottles; weak thick platy structure; friable; black (10YR 2/1) organic mixings; slightly acid; clear smooth boundary.

B21t—11 to 17 inches; dark grayish brown (10YR 4/2) heavy loam; common fine distinct strong brown (7.5YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; friable; few thin discontinuous clay films; few dark reddish brown (5YR 2/2) oxides; medium acid; clear smooth boundary.

B22t—17 to 26 inches; grayish brown (2.5Y 5/2) loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few thin discontinuous clay films; dark reddish brown (5YR 2/2) oxides; medium acid; gradual smooth boundary.

B23t—26 to 35 inches; grayish brown (2.5Y 5/2) loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few thin discontinuous clay films; slightly acid; abrupt wavy boundary.

C—35 to 60 inches; mottled grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/6) loam; massive; friable; few white lime accumulations; strong effervescence; mildly alkaline.

The thickness of solum and depth to free carbonates are typically 35 to 45 inches but range from 30 to 55 inches. The surface layer typically has mollic colors to a depth of about 8 inches.

The Ap horizon has hue of 10YR, value of 2 or 3 (3 or 4 dry), and chroma of 1. The A2 horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2). The Ap and A2 horizons are neutral to medium acid and are loam or clay loam. The upper part of the B horizon typically has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2. The lower part of the B horizon typically has hue of 2.5Y, value of 4 or 5, and chroma of 2 to 4 and has mottles. The B2 horizon ranges from slightly acid to strongly acid. The C horizon has hue of 2.5Y and is friable, calcareous loam or clay loam glacial till.

Marshan series

The Marshan series consists of poorly drained soils on low stream benches and in drainageways extending into the uplands. These soils formed in 24 to 40 inches of moderately permeable loamy sediment overlying rapidly permeable gravelly sand and sand. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Marshan soils are similar to Lawler soils and are commonly near Harcot, Hayfield, Lawler, and Talcot soils. Talcot and Harcot soils are calcareous. Hayfield and Lawler soils are somewhat poorly drained. Hayfield and Lawler soils are in higher areas than Marshan soils.

Typical pedon of Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes, 226 feet south and 110 feet east of the northwest corner of the SW1/4 sec. 12, T. 96 N., R. 21 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) light clay loam, black (10YR 2/1) dry; moderate medium subangular blocky structure parting to moderate fine granular; friable; few small pebbles; neutral; clear smooth boundary.

A12—8 to 18 inches; black (10YR 2/1) light clay loam, very dark gray (10YR 3/1) dry; few fine distinct grayish brown (2.5Y 5/2) mottles; friable; weak fine subangular blocky structure parting to weak fine granular; friable; few small pebbles; neutral; gradual smooth boundary.

B2g—18 to 28 inches; olive gray (5Y 5/2) heavy loam; few fine distinct light olive brown (2.5Y 5/6) mottles in the lower part; weak fine subangular blocky structure; friable; few very dark gray (10YR 3/1) krotovinas; few small pebbles; neutral; clear smooth boundary.

IIC1g—28 to 38 inches; gray (5Y 5/1) gravelly coarse sand; single grained; loose; estimated 15 percent gravel; neutral; clear wavy boundary.

IIC2g—38 to 60 inches; grayish brown (10YR 5/2) sand; single grained; loose; estimated 6 percent gravel; mildly alkaline.

Thickness of the solum and depth to sand and gravel range from 24 to 40 inches. Depth to carbonates ranges from 50 to 75 inches. The mollic epipedon ranges from 16 to 24 inches in thickness.

The Ap or A1 horizon is black (N 2/0 or 10YR 2/1). It is typically clay loam but ranges to silty clay loam that is high in sand and silt loam that is high in sand. The B2 horizon has value of 4 or 5 and chroma of 1 or 2. It is typically loam or light clay loam but ranges to silt loam, sandy loam, and silty clay loam. The B2 horizon is neutral to medium acid. The IIC horizon is gravelly coarse sand or sand.

Maxfield series

The Maxfield series consists of poorly drained soils on broad upland divides and in shallow drainageways. These soils formed in 20 to 40 inches of moderately permeable loess and the underlying moderately permeable glacial till. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Maxfield soils are similar to Klinger soils and are commonly near Dinsdale and Klinger soils. Dinsdale soils are on convex ridges and are well drained and moderately well drained. Klinger soils are on slightly concave side slopes and are somewhat poorly drained.

Typical pedon of Maxfield silty clay loam, 0 to 2 percent slopes, 460 feet west and 130 feet north of the southeast corner of sec. 4, T. 95 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak medium granular structure; friable; neutral; clear smooth boundary.

A12—8 to 13 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A3g—13 to 20 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; few fine distinct olive gray (5Y 5/2) mottles; weak fine subangular blocky structure; friable; few black (N 2/0) coatings on peds; neutral; clear wavy boundary.

B1g—20 to 26 inches; mottled dark gray (5Y 4/1) and olive (5Y 4/3) silty clay loam; weak fine subangular blocky structure; friable; nearly continuous dark gray (5Y 4/1) coatings on peds; few dark reddish brown (5YR 2/2) and strong brown (7.5YR 5/8) oxide concretions; neutral; clear smooth boundary.

B2g—26 to 31 inches; olive (5Y 5/3) heavy silt loam; weak fine subangular blocky structure; friable; nearly continuous olive gray (5Y 5/2) coatings on peds; common dark reddish brown (5YR 2/2) and strong brown (7.5YR 5/8) oxide concretions; neutral; clear smooth boundary.

IIB3—31 to 46 inches; strong brown (7.5YR 5/6) heavy loam; many medium distinct olive gray (5Y 5/2) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; few dark reddish brown (5YR 2/2) oxide concretions; few small pebbles; mildly alkaline; clear wavy boundary.

IIC—46 to 66 inches; strong brown (7.5YR 5/8) heavy loam; many medium prominent light olive gray (5Y 6/2) mottles; massive; firm; few dark reddish brown (5YR 2/2) oxide concretions; few small pebbles; strong effervescence; mildly alkaline.

The solum ranges from 36 to 55 inches in thickness. The loess typically is 24 to 40 inches but ranges from 18 to 42 inches in thickness. Carbonates are at a depth of about 40 to 60 inches. The mollic epipedon is 15 to 23 inches thick.

The A horizon is black (N 2/0 or 10YR 2/1) or very dark gray (10YR 3/1). The upper part of the B horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 to 3. It is silty clay loam or heavy silt loam. The IIC horizon is typically loam but ranges to light clay loam or sandy clay loam. It is moderately alkaline or mildly alkaline.

Minnetonka series

The Minnetonka series consists of poorly drained, slowly permeable soils on the uplands. These soils formed in lacustrine sediments 2 1/2 to 10 feet thick and the underlying glacial till. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

The Minnetonka soils are similar to Webster soils and are commonly near Kilkenny and Shorewood soils. Webster soils have less clay in the solum. Kilkenny soils are moderately well drained and do not have a mollic epipedon. They are on higher convex side slopes. Shorewood soils are somewhat poorly drained and are in higher areas than Minnetonka soils on slightly concave side slopes.

Typical pedon of Minnetonka silty clay loam, 0 to 2 percent slopes, 200 feet east and 100 feet south of the northwest corner of the NE1/4NE1/4 sec. 5, T. 97 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) heavy silty clay loam, black (10YR 2/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 17 inches; black (N 2/0) heavy silty clay loam, black (10YR 2/1) dry; moderate fine subangular blocky structure; firm, neutral; clear wavy boundary.

B1g—17 to 24 inches; very dark gray (5Y 3/1) light silty clay; many medium distinct olive (5Y 5/3) mottles; moderate medium subangular blocky structure; firm; few small yellowish red (5YR 4/8) oxide concretions; neutral; clear wavy boundary.

B21tg—24 to 30 inches; gray (5Y 5/1) light silty clay; moderate fine subangular blocky structure; firm; few gray (5Y 5/1) clay films on peds; few very dark gray (10YR 3/1) clay films in root channels; neutral; clear smooth boundary.

B22g—30 to 42 inches; gray (5Y 5/1) light silty clay; few fine distinct light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; firm; few small strong brown (7.5YR 5/6) oxide concretions; neutral; gradual smooth boundary.

Cg—42 to 60 inches; olive gray (5Y 5/2) light silty clay loam that is high in sand; common fine distinct strong brown (7.5YR 5/8) mottles; massive; firm; few yellowish red (5YR 4/8) and dark reddish brown (5YR 2/2) oxide concretions; slight effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates range from 28 to 52 inches. The mollic epipedon is 12 to 24 inches thick.

The A1 or Ap horizon is black (10YR 2/1 or N 2/0). The B2 horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2. The B2 horizon is clay or silty clay. The solum typically ranges from medium acid to neutral. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 2. It is typically silty clay loam or silty clay and contains free carbonates.

Mottland series

The Mottland series consists of well drained soils on crests and sides of ridges in the uplands. The upper part is moderately permeable, and the lower part is moderately rapidly permeable. These soils formed in 7 to 20 inches of loamy sediment overlying material weathered from limestone. The native vegetation was prairie grasses. Slope ranges from 2 to 30 percent.

Mottland soils are similar to Rossfield soils and are commonly near Sogn, Rockton, and Rossfield soils. Sogn soils have hard limestone bedrock at a depth of 4 to 20 inches. Rockton soils have hard limestone bedrock at a depth of 20 to 40 inches. Rossfield soils have 20 to 40 inches of loamy sediment overlying limestone residuum. Sogn and Rockton soils are below Mottland soils, and Rossfield soils are above Mottland soils.

Typical pedon of Mottland loam, 2 to 5 percent slopes, 850 feet south and 350 feet west of the northeast corner of the SE1/4 sec. 11, T. 96 N., R 19 W., in a cultivated field:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) heavy loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak fine granular; friable; estimated 10 percent hard gravelly limestone fragments (1 to 4 centimeters); strong effervescence; mildly alkaline; clear smooth boundary.

IIC1—8 to 40 inches; light yellowish brown (2.5Y 6/4) channery loam; massive; very friable when moist, about 30 percent is extremely hard when dry; about 20 percent by volume soft limestone fragments; violent effervescence; moderately alkaline; gradual smooth boundary.

IIC2—40 to 60 inches; yellowish brown (10YR 5/6) channery fine sandy loam; massive; very friable when moist, about 25 percent is extremely hard when dry; about 25 percent by volume soft limestone fragments; violent effervescence; moderately alkaline.

Thickness of the solum and depth to material weathered from arenaceous limestone range from 7 to 20 inches. Free carbonates typically are present in all horizons, but the Ap or A1 horizon is neutral in some pedons.

The Ap or A1 horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). It is typically loam but in places is silt loam that is high in sand. Coarse fragments make up 3 to 10 percent of the Ap or A1 horizon. The IIC horizon has hue of 7.5YR, 10YR, and 2.5Y; value of 5 to 7; and chroma of 4 to 8. The IIC horizon ranges from sandy loam to loam or silt loam that is high in sand. It typically is channery but some horizons are flaggy. Content of coarse fragments in the IIC horizon typically is 10 to 30 percent but ranges from 5 to 40 percent. The IIC horizon is mildly alkaline or moderately alkaline.

Nicollet series

The Nicollet series consists of somewhat poorly drained, moderately permeable soils on glacial till uplands. These soils formed in loamy glacial till under prairie grasses. Slope ranges from 1 to 3 percent.

Nicollet soils are similar to Webster soils and are commonly near Clarion, Le Sueur, and Webster soils. Le Sueur soils have a thinner dark colored A horizon than Nicollet soils. Clarion soils are well drained and are on convex side slopes above or below Nicollet soils. Webster soils are poorly drained and are on concave side slopes below Nicollet soils.

Typical pedon of Nicollet loam, 1 to 3 percent slopes, 230 feet west and 155 feet north of the southeast corner of the SW1/4SE1/4 sec. 8, T. 96 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; black (10YR 2/1) heavy loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 15 inches; black (10YR 2/1) heavy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.

A3—15 to 23 inches; very dark grayish brown (10YR 3/2) heavy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; very dark brown (10YR 2/2) coatings on peds; neutral; clear smooth boundary.

B2—23 to 29 inches; mottled dark grayish brown (2.5Y 4/2) and olive brown (2.5Y 4/4) heavy loam; weak fine subangular blocky structure; friable; few very dark grayish brown (2.5Y 3/2) coatings on peds; very few small strong brown (7.5YR 5/6) and black (5YR 2/1) oxide concretions; neutral; clear wavy boundary.

C—29 to 60 inches; light olive brown (2.5Y 5/4) loam; common medium distinct yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) mottles; massive; friable; few small pebbles; violent effervescence; mildly alkaline.

Thickness of the solum and depth to carbonates are typically 30 to 36 inches but range from 20 to 48 inches. The mollic epipedon is 12 to 24 inches thick.

The A1 or Ap horizon is black (10YR 2/1) or very dark gray (10YR 3/1). It is typically loam but in places is clay loam. The B2 horizon is typically dark grayish brown (10YR 4/2 or 2.5Y 4/2), olive brown (2.5YR 4/4), or light olive brown (2.5YR 5/4) loam or clay loam. The solum is neutral or slightly acid. The C horizon has hue of 2.5Y, value of 5, and chroma of 2 to 4. It has mottles and is calcareous loam or clay loam.

Okoboji series

The Okoboji series consists of very poorly drained, moderately slowly permeable soils in depressions on glacial till uplands. These soils formed in local alluvium under marsh grasses. Slopes are 0 to 1 percent.

Okoboji soils are similar to Minnetonka soils and are commonly near Minnetonka and Rolfe soils. Minnetonka and Rolfe soils have a thinner A1 horizon than Okoboji soils. Rolfe soils have a light colored A2 horizon. Minnetonka soils are higher than Okoboji soils on the landscape.

Typical pedon of Okoboji silty clay loam, 0 to 1 percent slopes, 560 feet west and 80 feet north of the southeast corner of sec. 7, T. 97 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 20 inches; black (N 2/0) heavy silty clay loam, black (10YR 2/1) dry; moderate fine granular structure; friable; mildly alkaline; gradual smooth boundary.

A3—20 to 29 inches; black (10YR 2/1) heavy silty clay loam, very dark gray (10YR 3/1) dry; few fine distinct olive gray (5Y 5/2) mottles; weak fine subangular blocky structure; friable; neutral; clear wavy boundary.

Bg—29 to 46 inches; olive gray (5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and olive brown (2.5Y 4/4) mottles; very weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

Cg—46 to 60 inches; olive gray (5Y 5/2) light silty clay loam; common fine distinct olive brown (2.5Y 4/4) and yellowish brown (10YR 5/6) mottles; massive; friable; few small white (10YR 8/1) soft lime concretions; strong effervescence; mildly alkaline.

The solum ranges from 40 to 60 inches in thickness. Depth to carbonates ranges from 20 to 50 inches. The mollic epipedon ranges from 24 to 36 inches in thickness.

The A horizon is black (N 2/0 or 10YR 2/1) silty clay loam. The Bg horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2 and has mottles that are higher in chroma. It is typically silty clay loam or silty clay. The solum is neutral or mildly alkaline. The Cg horizon is typically calcareous silty clay loam, but some pedons have thin strata of loam. The Cg horizon is similar to the Bg horizon in color and is mildly alkaline.

Oran series

The Oran series consists of somewhat poorly drained soils on slightly convex crests and sides of ridges in the uplands. These soils formed in 14 to 24 inches of moderately permeable silty and loamy sediments and the underlying moderately permeable loamy glacial till. The native vegetation was trees and prairie grasses. Slope ranges from 1 to 3 percent.

Oran soils are similar to Bassett soils and are commonly near Bassett and Readlyn soils. Bassett soils have higher chroma in the B horizon than Oran soils and are on convex side slopes above or below Oran soils. Readlyn soils have a thicker dark colored A horizon.

Typical pedon of Oran silt loam, 1 to 3 percent slopes, 1,170 feet south and 430 feet west of the center of sec. 11, T. 96 N., R. 21 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam that is high in sand, dark grayish brown (10YR 4/2) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam that is high in sand, grayish brown (10YR 5/2) dry; weak medium platy structure parting to moderate fine granular; friable; very dark grayish brown (10YR 3/2) coatings on peds; light brownish

gray (10YR 6/2) dry silt and sand coatings on peds; medium acid; clear smooth boundary.

B1—13 to 19 inches; dark grayish brown (2.5Y 4/2) heavy loam; few fine faint strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

IIB2t—19 to 32 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) loam; moderate medium prismatic structure parting to weak medium subangular blocky; firm; few thin discontinuous dark grayish brown (10YR 4/2) clay films and clay-filled pores; slightly acid; gradual smooth boundary.

IIB3t—32 to 41 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) loam; weak medium prismatic structure; firm; few thin discontinuous dark grayish brown (10YR 4/2) clay films; slightly acid; abrupt wavy boundary.

IIC—41 to 72 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) loam; massive; firm; common soft lime accumulations; strong effervescence; mildly alkaline.

The thickness of solum is typically greater than 40 inches but ranges from 30 to 50 inches. Depth to carbonates ranges from 40 to 70 inches. The surface layer typically has mollic colors to a depth of about 8 inches.

The Ap horizon is typically very dark brown (10YR 2/2) but in places is very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2). The A2 horizon is typically dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). The A horizon ranges from silt loam that is high in sand to loam and light clay loam. The IIBt horizon typically ranges from loam to clay loam but in some pedons is sandy clay loam. The soil is strongly acid or very strongly acid in the most acid part.

Palms series

The Palms series consists of very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on uplands, on stream benches, and on flood plains. These soils formed in 16 to 50 inches of organic material overlying loamy mineral sediment. The native vegetation was marsh grasses and sedges. Slope ranges from 0 to 4 percent.

Palms soils are similar to Houghton soils and are commonly near Canisteo, Harps, Houghton, and Okoboji soils. Canisteo, Harps, and Okoboji soils are mineral soils. Canisteo and Harps soils are calcareous and are in higher areas than Palms soils. Houghton soils have organic layers greater than 51 inches thick.

Typical pedon of Palms muck, 0 to 1 percent slopes, 733 feet west and 77 feet south of the northeast corner of sec. 15, T. 97 N., R. 22 W., in a cultivated field:

Oap—0 to 8 inches; black (N 2/0) sapric material, broken face and rubbed; about 5 percent fiber, less than 5 percent rubbed; moderate very fine granular structure; very friable; neutral; clear smooth boundary.

Oa2—8 to 17 inches; black (N 2/0) sapric material, broken face and rubbed; about 5 percent fiber, less than 5 percent rubbed; fibers are herbaceous; very weak fine granular structure; very friable; neutral; clear smooth boundary.

Oa3—17 to 36 inches; black (10YR 2/1) sapric material, broken face and rubbed; about 20 percent fiber, less than 5 percent rubbed; fibers are herbaceous; few fine distinct reddish brown (5YR 4/4) mottles; thick platy structure parting to very weak fine granular; very friable; neutral, clear smooth boundary.

IIC1g—36 to 42 inches; gray (5Y 5/1) loam; common fine distinct olive brown (2.5Y 4/4) mottles; massive; friable; neutral; clear wavy boundary.

IIC2g—42 to 60 inches; mottled gray (5Y 5/1) and yellowish red (5YR 4/6) loam; massive; friable; strong effervescense; moderately alkaline.

The depth to mineral soil typically is 20 to 42 inches but ranges from 16 to 50 inches. The organic layers are black (N 2/0 or 10YR 2/1) or very dark brown (10YR 2/2). The organic part is primarily sapric, but hemic layers 10 inches or less thick are present in some pedons. The organic layers are neutral to mildly alkaline. The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 7; and chroma of 1 to 6. It is neutral to moderately alkaline silty clay loam to fine sandy loam.

Raddle series

The Raddle series consists of well drained, moderately permeable soils on stream benches and uplands. Raddle soils formed in 46 to 60 inches of silty alluvial sediment overlying sand or gravel. The native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Raddle soils are similar to Waukee soils and are commonly near Saude and Waukee soils. Saude and Waukee soils have more sand in the solum than Raddle soils and are not so deep to coarse textured material.

Typical pedon of Raddle silt loam, 1 to 3 percent slopes, 280 feet east and 210 feet north of the center of sec. 36, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) heavy silt loam, very dark grayish brown (10YR 3/2) dry; weak very fine granular structure; friable; medium acid; clear smooth boundary.

A12—8 to 15 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak very fine granular structure; slightly acid; gradual smooth boundary.

B1—15 to 23 inches; dark yellowish brown (10YR 4/4) heavy silt loam; weak very fine subangular blocky structure; friable; nearly continuous dark brown (10YR 3/3) coatings on peds; few grayish brown

(10YR 5/2) silt coatings, dry; slightly acid; gradual smooth boundary.

B2—23 to 40 inches; dark yellowish brown (10YR 4/4) heavy silt loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; discontinuous dark brown (10YR 3/3) coatings on peds; few grayish brown (10YR 5/2) silt coatings, dry; medium acid; clear smooth boundary.

B3—40 to 54 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; common grayish brown (10YR 5/2) silt coatings, dry; slightly acid; clear smooth boundary.

IIC—54 to 65 inches; yellowish brown (10YR 5/4) heavy loamy sand; few fine distinct strong brown (7.5YR 5/6) mottles; massive; loose; neutral.

Thickness of the solum is typically 50 to 60 inches but ranges from 40 to 65 inches. The mollic epipedon is 12 to 24 inches thick.

The A1 and Ap horizons are black (10YR 2/1) or very dark brown (10YR 2/2). They are neutral to medium acid. The B2 horizon ranges from dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/6). The B2 horizon is slightly acid or medium acid silt loam or silty clay loam. The C horizon is brown (10YR 4/3) to yellowish brown (10YR 5/6), slightly acid to mildly alkaline loamy sand to gravelly sand.

Readlyn series

The Readlyn series consists of somewhat poorly drained soils on slightly convex crests and sides of ridges on the uplands. These soils formed in 14 to 24 inches of moderately permeable loamy sediment and the underlying moderately permeable loamy glacial till. The native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Readlyn soils are similar to Kenyon soils and are commonly near Kenyon and Oran soils. Kenyon soils are moderately well drained and have higher chroma throughout the B horizon than Readlyn soils. Kenyon soils are on convex side slopes above or below Readlyn soils. Oran soils have a thinner dark colored A horizon.

Typical pedon of Readlyn loam, 1 to 3 percent slopes, 520 feet east and 97 feet south of the northwest corner of the NE1/4 sec. 30, T. 95 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; black (10YR 2/1) heavy loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; firm; neutral; abrupt smooth boundary.

A12—8 to 17 inches; very dark brown (10YR 2/2) heavy loam, very dark grayish brown (10YR 3/2) dry; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

B2—17 to 22 inches; brown (10YR 5/3) heavy loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; dark grayish brown (10YR 4/2) coatings on peds; few dark reddish brown (5YR 2/2) oxides; slightly acid; clear smooth boundary.

IIB21—22 to 29 inches; mottled grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) heavy loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few dark reddish brown (5YR 2/2) oxides; medium acid; clear smooth boundary.

IIB22—29 to 39 inches; grayish brown (2.5Y 5/2) loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; firm; common dark reddish brown (5YR 2/2) oxides; medium acid; gradual smooth boundary.

IIB3—39 to 50 inches; mottled grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) loam; weak medium prismatic structure; firm; common dark reddish brown (5YR 2/2) oxides; slightly acid; gradual smooth boundary.

IIC—50 to 60 inches; mottled grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) loam; massive; firm; common dark reddish brown (5YR 2/2) oxides; neutral.

Thickness of the solum and depth to carbonates is typically 42 to 70 inches. The mollic epipedon is 16 to 20 inches thick.

The A horizon is black (10YR 2/1) in the upper part and black (10YR 2/1) to very dark grayish brown (10YR 3/2) in the lower part. It is typically loam but less commonly is silty clay loam or silt loam. The A horizon ranges from neutral to medium acid. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 8. The IIB2 horizon is medium acid or strongly acid. The IIB and IIC horizons are loam, clay loam, or sandy clay loam.

Ripon series

The Ripon series consists of well drained, moderately permeable soils on loess-covered uplands. These soils formed in loess and a thin layer of glacial till or glacial sediment over hard limestone bedrock at a depth of 20 to 40 inches. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

These soils are taxadjuncts to the Ripon series because they lack the increase in clay required for an argillic horizon. This difference does not alter the usefulness or behavior of the soils.

Ripon soils are similar to Rockton soils and are near Dinsdale, Rockton, and Rossfield soils. Dinsdale soils are above Ripon soils and do not have a substratum of limestone above a depth of 60 inches. In the upper part of the solum, Rockton soils have loamy sediment with more sand. Rossfield soils have a substratum of friable arenaceous limestone.

Typical pedon of Ripon silt loam, 30 to 40 inches to limestone, 0 to 2 percent slopes, 850 feet south and 55 feet east of the northwest corner of sec. 24, T. 95 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) heavy silt loam, very dark grayish brown (10YR 3/2) dry; weak very fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 14 inches; very dark grayish brown (10YR 3/2) heavy silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure parting to weak fine granular; friable; very dark brown (10YR 2/2) coatings on peds; slightly acid; clear wavy boundary.

B1—14 to 19 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; discontinuous dark brown (10YR 3/3) coatings on peds; slightly acid; clear smooth boundary.

B2t—19 to 26 inches; dark yellowish brown (10YR 4/4) light silty clay loam; weak medium subangular blocky structure; friable; brown (10YR 4/3) coatings on peds; few thin dark brown (10YR 3/3) clay films; few grayish brown (10YR 5/2), dry, silt coatings; slightly acid; clear smooth boundary.

IIB31t—26 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium subangular blocky structure; friable; few thin patchy clay films and some clay bridging sand grains; few small pebbles; slightly acid; clear smooth boundary.

IIIB32t—32 to 36 inches; strong brown (7.5YR 5/6) silty clay; weak medium subangular blocky structure; firm; few strong brown (7.5YR 5/8) and black (5YR 2/1) oxide concretions; few thin clay films; neutral; abrupt wavy boundary.

IIIR—36 inches; shattered hard level-bedded limestone bedrock.

Thickness of the solum and depth to hard limestone bedrock are 24 to 36 inches but range from 20 to 40 inches. The loess is 20 to 36 inches thick and commonly makes up most of the solum. The underlying glacial till ranges from 1 to 10 inches in thickness. The mollic epipedon ranges from 10 to 15 inches in thickness.

The A1 or Ap horizon and the A3 horizon have hue of 10YR, value of 2 or 3, and chroma of 1 to 3. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is slightly acid to strongly acid silt loam, heavy silt loam, or silty clay loam. The IIB horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is typically clay loam or loam. Thin layers of slightly acid to moderately alkaline silty clay or clay residuum are above the limestone in places. The bedrock typically is shattered in the upper part.

Rockton series

The Rockton series consists of well drained, moderately permeable soils on ridge crests, on sides of stream benches, and on the uplands. These soils formed in 20 to 40 inches of loamy sediment overlying limestone bedrock. The native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Rockton soils are similar to Kensett soils and are commonly near Faxon, Kensett, Sogn, and Tilfer soils. Faxon soils are in drainageways and are poorly drained. Kensett soils are somewhat poorly drained and are in lower areas than Rockton soils. Sogn soils have limestone bedrock at a depth of 4 to 20 inches and are on convex side slopes below Rockton soils. Tilfer soils are calcareous and poorly drained and are on concave side slopes below Rockton soils.

Typical pedon of Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes, 1,130 feet east and 105 feet south of the northwest corner of sec. 27, T. 97 N., R. 19 W., in a cultivated field:

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; black (10YR 2/1) coatings on peds; neutral; clear smooth boundary.

A3—7 to 13 inches; very dark grayish brown (10YR 3/2) heavy loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; very dark brown (10YR 2/2) coatings on peds; neutral; clear wavy boundary.

B2t—13 to 23 inches; brown (7.5YR 4/4) light clay loam; moderate fine and medium subangular blocky structure; friable; few thin patchy dark brown (7.5YR 3/2) clay films on peds and in pores and root channels; few small pebbles; slightly acid; clear wavy boundary.

B31t—23 to 29 inches; brown (7.5YR 4/4) sandy clay loam; weak coarse subangular blocky structure; friable; sand grains coated and bridged with clay; few small pebbles; medium acid; clear wavy boundary.

IIB32t—29 to 34 inches; reddish brown (5YR 4/4) light clay; weak medium subangular blocky structure; firm; thin clay films on peds; slightly acid; abrupt wavy boundary.

IIR—34 inches; hard shattered limestone overlying hard level-bedded limestone bedrock.

Thickness of the solum and depth to limestone bedrock range from 20 to 40 inches. The mollic epipedon ranges from 10 to 18 inches in thickness.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is typically loam but in places is silt loam. The A horizon and the upper part of the B horizon range from strongly acid to neutral. The B horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 3 or 4. The B horizon is loam, sandy clay loam, or clay loam. The IIB horizon is medium acid to neutral clay loam, silty clay loam, silty clay, or clay.

Rolfe series

The Rolfe series consists of very poorly drained, slowly permeable soils in depressions on the uplands. These soils formed in glacial drift and local alluvium in shallow depressions. The native vegetation was wet prairie and marsh grasses. Slope ranges from 0 to 1 percent.

Rolfe soils are similar to Okoboji soils and are commonly near Webster soils. Okoboji and Webster soils have a thicker A1 horizon than Rolfe soils and do not have an A2 horizon. Webster soils are in higher areas than Rolfe soils.

Typical pedon of Rolfe silt loam, 0 to 1 percent slopes, 2,300 feet west and 580 feet north of the southeast corner of sec. 18, T. 96 N., R. 22 W., in a cultivated field:

Ap—0 to 9 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate very fine subangular blocky structure; friable; medium acid; abrupt smooth boundary.

A21—9 to 18 inches; gray (10YR 5/1) silt loam, light gray (10YR 7/1) dry; few fine distinct yellowish brown (10YR 5/4) mottles; moderate thin platy structure; friable; slightly acid; clear smooth boundary.

A22—18 to 21 inches; gray (10YR 5/1) silt loam, light gray (10YR 7/1) dry; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure; friable; slightly acid; abrupt smooth boundary.

B21tg—21 to 27 inches; olive gray (5Y 4/2) silty clay; common fine distinct yellowish brown (10YR 5/6) mottles; strong very fine subangular blocky and angular blocky structure; firm; very dark gray (10YR 3/1) coatings on peds; nearly continuous clay films; slightly acid; gradual smooth boundary.

B22tg—27 to 34 inches; olive gray (5Y 5/2) heavy clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to weak medium subangular blocky; firm; nearly continuous very dark gray (10YR 3/1) coatings on prisms; discontinuous clay films; slightly acid; gradual smooth boundary.

B23g—34 to 43 inches; olive gray (5Y 5/2) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; firm; very dark grayish brown (10YR 3/2) coatings on peds; neutral; clear smooth boundary.

C—43 to 60 inches; dark grayish brown (2.5Y 4/2) loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; massive; very friable; few dark reddish brown (5YR 2/2) oxides; neutral.

The solum is about 40 to 55 inches thick. Depth to carbonates ranges from 42 to 70 inches. The surface layer typically has mollic colors to a depth of about 9 inches.

The Ap horizon ranges from black (10YR 2/1) to very dark gray (10YR 3/1). It is typically silt loam but in places is loam or light silty clay loam. The A2 horizon is typically dark gray (10YR 4/1) or gray (10YR 5/1 or 10YR 6/1) silt loam or loam. The A horizon ranges from strongly acid to slightly acid, and the B horizon ranges from slightly acid to neutral. The B2 horizon has hue of 5Y, value of 4 to 6, and chroma of 1 or 2. The upper part of the B horizon is light clay or silty clay. The C horizon ranges from sandy loam to clay loam and is neutral or mildly alkaline.

Rossfield series

The Rossfield series consists of well drained soils on crests and sides of ridges in the uplands. The upper part is moderately permeable, and the lower part is moderately rapidly permeable. These soils formed in 20 to 40 inches of silty or loamy sediment overlying material weathered from limestone. The native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Rossfield soils are similar to Mottland soils and are commonly near Calamine, Mottland, Rockton, and Rossfield Variant soils. Calamine soils are poorly drained and have shale at a depth of 20 to 40 inches. Mottland soils have friable weathered limestone below a depth of 7 to 20 inches. Rockton soils have hard limestone bedrock at a depth of 20 to 40 inches. Rossfield Variant soils are somewhat poorly drained. Calamine and Rossfield Variant soils are on concave side slopes above Rossfield soils. Mottland and Rockton soils are on convex side slopes below Rossfield soils.

Typical pedon of Rossfield silt loam, 0 to 2 percent slopes, 335 feet east and 250 feet south of the northwest corner of the SW1/4 sec. 31, T. 97 N., R. 20 W., in a cultivated field:

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; moderate fine and very fine granular structure; friable; neutral; clear smooth boundary.

A12—9 to 13 inches; very dark grayish brown (10YR 3/2) light silty clay loam, dark grayish brown (10YR 4/2) dry; small amount of yellowish brown (10YR 5/6) in lower fringe; moderate fine granular structure; friable; continuous very dark brown (10YR 2/2) coatings on peds; neutral; clear wavy boundary.

B1—13 to 19 inches; mixed very dark grayish brown (10YR 3/2) and yellowish brown (10YR 5/6) silty clay loam that is high in sand; weak medium subangular blocky structure parting to weak very fine subangular blocky; friable; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) coatings on peds; neutral; gradual smooth boundary.

B2—19 to 29 inches; yellowish brown (10YR 5/6) light clay loam; weak medium subangular blocky structure; friable; dark yellowish brown (10YR 4/4) coatings on peds; slightly acid; clear smooth boundary.

IIC—29 to 60 inches; brownish yellow (10YR 6/8) and olive yellow (2.5Y 6/8) channery loam; massive; very friable; about 20 percent by volume soft limestone fragments; strong effervescence; mildly alkaline.

Thickness of the solum and depth to carbonates typically are 24 to 40 inches but are as shallow as 20 inches in some pedons. Thickness of the mollic epipedon commonly is 12 to 18 inches but ranges from 10 to 20 inches.

The Ap or A1 horizon is very dark brown (10YR 2/2), black (10YR 2/1), or very dark grayish brown (10YR 3/2). Texture is typically silt loam or silty clay loam. The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. Texture is typically silty clay loam or silt loam but in places is clay loam or loam in the lower part. The A and B horizons are slightly acid or neutral. The IIC horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 5 to 7; and chroma of 6 to 8. Texture ranges from channery sandy loam to channery loam. Content of limestone fragments less than 6 inches in diameter in the IIC horizon is typically 10 to 30 percent but ranges from 10 to 40 percent. This horizon is mildly alkaline or moderately alkaline.

Rossfield Variant

The Rossfield Variant consists of somewhat poorly drained soils on concave heads of upland drainageways. The upper part is moderately permeable, and the lower part is moderately rapidly permeable. These soils formed in 20 to 40 inches of silty sediment and the underlying material weathered from limestone. The native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Rossfield Variant soils are similar to Rossfield soils and are commonly near Mottland and Rossfield soils. Mottland soils are steeper and have material weathered from limestone below a depth of 7 to 20 inches. Rossfield soils are on convex side slopes and are well drained.

Typical pedon of Rossfield Variant silty clay loam, 1 to 3 percent slopes, 620 feet north and 80 feet east of the center of sec. 6, T. 96 N., R. 20 W., in a cultivated field:

Ap—0 to 9 inches; black (10YR 2/1) light silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; firm; neutral; abrupt smooth boundary.

A12—9 to 19 inches; black (10YR 2/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; few fine distinct dark grayish brown (10YR 4/2) mottles; moderate very fine subangular blocky structure; friable; few dark reddish brown (5YR 2/2) oxides; neutral; clear smooth boundary.

B1—19 to 25 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct light olive brown (2.5Y 5/6) mottles; moderate fine subangular blocky structure; friable; very dark grayish brown (2.5Y 3/2) coatings on peds; few dark reddish brown (5YR 2/2) oxides; neutral; clear smooth boundary.

B2—25 to 30 inches; mottled yellowish brown (10YR 5/6) and dark grayish brown (2.5Y 4/2) silty clay loam; moderate fine subangular blocky structure; firm; few pebbles greater than 2 millimeters in the lower part; mildly alkaline; clear smooth boundary.

IIB3—30 to 38 inches; yellowish brown (10YR 5/6) silty clay; common fine faint strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; olive (5Y 5/3) coatings on peds; strong effervescence; mildly alkaline; clear wavy boundary.

IIC—38 to 60 inches; mottled brownish yellowish (10YR 6/8) and pale olive (5Y 6/3) channery silty clay loam; massive; firm when moist, hard when dry; about 25 percent soft limestone fragments; violent effervescence; moderately alkaline.

Thickness of the solum and depth to carbonates are typically 24 to 40 inches but in some pedons are as little as 20 inches. Thickness of the mollic epipedon commonly is 12 to 20 inches but ranges from 10 to 24 inches.

The Ap or A1 horizon is black (N 2/0 or 10YR 2/1) silty clay loam or silt loam. It is slightly acid or neutral. The B1 horizon is silt loam or silty clay loam. The B2 and B3 horizons have hue of 10YR, 2.5Y, and 5Y; value of 4 or 5; and chroma of 2 to 6. The B horizon is neutral or mildly alkaline. The B horizon is typically silty clay loam but ranges from heavy silt loam to light silty clay. The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7; and chroma of 2 to 8. It ranges from flaggy sandy loam to channery silty clay loam with flagstones of limestone. The IIC horizon is typically 10 to 30 percent fragments of limestone and is mildly alkaline or moderately alkaline.

Salida series

The Salida series consists of excessively drained, very rapidly permeable soils on knobs, ridges, escarpments and side slopes on the uplands and on stream benches. These soils formed in calcareous sandy and gravelly glacial deposits under prairie grasses. Slope ranges from 2 to 18 percent.

Salida soils are similar to Flagler soils and are commonly near Storden soils. Flagler soils have a thicker, more acid solum with less gravel than Salida soils. Storden soils formed in glacial till and are on convex upland side slopes.

Typical pedon of Salida sandy loam, 2 to 9 percent slopes, 775 feet east and 600 feet south of the center of sec. 5, T. 96 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak

medium granular structure; friable; neutral; abrupt smooth boundary.

B2—8 to 16 inches; brown (10YR 4/3) gravelly loamy sand; weak fine granular structure; very friable; mildly alkaline; abrupt wavy boundary.

C1—16 to 21 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grained; loose; few faint yellowish brown (10YR 5/6) oxides; violent effervescence; mildly alkaline; clear smooth boundary.

C2—21 to 60 inches; yellowish brown (10YR 5/4) gravelly very coarse sand; single grained; loose; few red (2.5YR 4/8) oxides; strong effervescence; mildly alkaline.

Thickness of the solum typically is 7 to 16 inches but ranges from 7 to 20 inches. The mollic epipedon ranges from 7 to 10 inches in thickness. The depth to carbonates ranges from 0 to 20 inches.

The A horizon is very dark brown (10YR 2/2) to dark brown (10YR 3/3). It ranges from sandy loam to gravelly loamy sand and is slightly acid to mildly alkaline. The B horizon is brown (10YR 4/3) or dark yellowish brown (10YR 4/4), neutral or mildly alkaline gravelly loamy sand to gravelly sand. The C horizon ranges from brown (10YR 4/3) to light yellowish brown (10YR 6/4) and from gravelly loamy sand to sand and gravel. The amount of gravel in the C horizon ranges from 15 to 50 percent.

Saude series

The Saude series consists of well drained soils on stream benches. Some areas are in the uplands. These soils formed in 20 to 30 inches of moderately permeable to moderately rapidly permeable loamy sediment and the underlying very rapidly permeable loamy sand and gravelly coarse sand. The native vegetation was prairie grasses. Slope ranges from 0 to 9 percent.

Saude soils are similar to Waukee soils and are commonly near Lawler, Marshan, and Waukee soils. Waukee soils are deeper to sand and gravel than Saude soils. Lawler soils are somewhat poorly drained. Marshan soils are poorly drained. Lawler and Marshan soils are in lower areas than Saude soils.

Typical pedon of Saude loam, 0 to 2 percent slopes, 230 feet west and 90 feet north of the southeast corner of sec. 25, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A3—8 to 15 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; includes a small amount of dark yellowish brown (10YR 4/4); weak medium subangular blocky structure parting to moderate fine granular; friable; slightly acid; clear wavy boundary.

B2—15 to 22 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; dark brown (10YR 3/3) coatings on peds; medium acid; clear wavy boundary.

B3—22 to 25 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; strongly acid; clear smooth boundary.

IIC1—25 to 52 inches; dark yellowish brown (10YR 4/4) loamy sand; single grained; loose; medium acid; gradual smooth boundary.

IIC2—52 to 72 inches; dark yellowish brown (10YR 4/4) gravelly coarse sand; single grained; loose; slightly acid.

The thickness of solum is typically 24 to 44 inches and ranges from 18 to 54 inches. Depth to loamy sand, sand, and gravelly coarse sand is typically 20 to 30 inches and ranges from 18 to 36 inches. Carbonates are leached to a depth of 6 feet or more.

The A1 or Ap horizon is black (10YR 2/1) or very dark brown (10YR 2/2) loam. The B2 and B3 horizons typically have hue of 10YR, value of 4 or 5, and chroma of 3, 4, or 6. Average clay content of the control section above the contrasting texture is less than 18 percent. The B2 horizon is medium acid or strongly acid. The IIC horizon has hue of 10YR, value of 4 or 5, and chroma of 4 or 6. The upper part of the IIC horizon is medium acid or strongly acid. The IIC horizon is typically loamy sand and sand with some gravel.

Schley series

The Schley series consists of somewhat poorly drained soils on slightly concave, lower side slopes adjacent to drainageways on uplands. These soils formed in about 30 to 45 inches of moderately permeable loamy sediment and the underlying moderately permeable loamy glacial till. The native vegetation was prairie grasses and forest. Slope ranges from 1 to 4 percent.

Schley soils are similar to Floyd soils and are commonly near Clyde soils. Clyde soils are poorly drained and are below Schley soils in the drainageways. Both Clyde and Floyd soils have a mollic epipedon.

Typical pedon of Schley loam, 1 to 4 percent slopes, 223 feet south and 67 feet west of the northeast corner of the NW1/4 sec. 28, T. 95 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

B1—8 to 15 inches; brown (10YR 4/3) loam; common fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few small pebbles; strongly acid; gradual smooth boundary.

B2—15 to 26 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) heavy loam; grayish brown (2.5Y 5/2) coatings on peds; weak medium subangular blocky structure; friable; few strong brown (7.5YR 5/8) oxide concretions; pebble band in lower part of horizon, few small pebbles throughout; strongly acid; gradual smooth boundary.

B31t—26 to 38 inches; mottled pale brown (10YR 6/3) grayish brown (10YR 5/2) and brown (7.5YR 4/4) sandy loam; very weak coarse subangular blocky structure; very friable; clay bridging sand grains; strongly acid; clear smooth boundary.

IIB32t—38 to 48 inches; mottled pale brown (10YR 6/3) and brown (7.5YR 4/4) loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; friable; clay bridging sand grains; few dark reddish brown (5YR 2/2) oxide concretions; medium acid; gradual smooth boundary.

IIC1—48 to 66 inches; light yellowish brown (2.5Y 6/4) and strong brown (7.5YR 5/6) stratified loam and coarse sandy loam; massive; friable; very few small pebbles; slightly acid; clear smooth boundary.

IIC2—66 to 76 inches; strong brown (7.5YR 5/8) heavy loam; many medium distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; few small pebbles; slightly acid.

The solum ranges from 40 to 60 inches in thickness. The depth to carbonates is typically greater than 60 inches. Thickness of the mollic colors ranges from 6 to 9 inches.

The Ap horizon ranges from black (10YR 2/1) to very dark gray (10YR 3/1) and very dark brown (10YR 2/2). The A2 horizon, where present, ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3) with few to many grayish mottles. The A horizon is silt loam that is high in sand. The B horizon ranges from brown (10YR 4/3) with common mottles to light olive brown (2.5Y 5/6) with few to common grayish mottles. The B horizon ranges from loam to sandy loam and sandy clay loam. The IIB horizon is loam, light clay loam, or sandy clay loam. The Ap horizon ranges from neutral to medium acid. The A2 and B2 horizons are strongly acid or very strongly acid, and the B3 horizon is slightly acid to strongly acid. Some pedons have strata of loamy sand 2 to 5 inches thick at the contact of the loamy sediment and the underlying glacial till.

Shandep series

The Shandep series consists of very poorly drained soils in depressions on stream benches and outwash plains. Permeability is moderate and moderately rapid in the solum and rapid in the underlying sandy substratum. These soils formed in loamy sediment overlying sand and gravel. The native vegetation was prairie grasses. Slope is 0 to 1 percent.

Shandep soils are similar to Harcot soils and are commonly near Harcot, Marshan, and Talcot soils. Harcot, Marshan, and Talcot soils have a mollic epipedon less than 24 inches thick and a coarse textured substratum above a depth of 40 inches. These soils are typically in higher areas than Shandep soils.

Typical pedon of Shandep clay loam, 0 to 1 percent slopes, 1,400 feet south and 1,700 feet west of the northeast corner of sec. 9, T. 94 N., R. 21 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

A12—8 to 20 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; few medium distinct dark reddish brown (5YR 3/4) mottles; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A13—20 to 29 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; common medium distinct olive gray (5Y 5/2) mottles and few fine distinct dark reddish brown (5YR 3/4) mottles; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

B21—29 to 32 inches; olive gray (5Y 5/2) heavy loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

B22—32 to 37 inches; olive gray (5Y 5/2) heavy loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

B3—37 to 45 inches; olive gray (5Y 4/2) sandy loam; weak medium subangular blocky structure; very friable; few pebbles greater than 2 millimeters; neutral; gradual smooth boundary.

IIC—45 to 60 inches; gray (5Y 5/1) loamy coarse sand; single grained; loose; few pebbles greater than 2 millimeters; few fine distinct strong brown (7.5YR 5/8) soft oxides; neutral.

Thickness of the solum and depth to the IIC horizon typically are 44 to 48 inches but range from 40 to 55 inches. The mollic epipedon typically is 26 to 32 inches thick.

The A horizon has hue of 5Y or is neutral and has value of 2 or 3 and chroma of 1 or less. It is typically clay loam or heavy loam but ranges to silty clay loam that is high in sand. The B2 horizon typically has hue of 5Y or is neutral and has value of 4 or 5 and chroma of 2 or less. The B2 horizon is typically clay loam, heavy loam, or silty clay loam that is high in sand. The IIC horizon is typically loamy coarse sand or gravelly loamy sand.

Shorewood series

The Shorewood series consists of somewhat poorly drained, moderately slowly permeable and slowly permeable soils on slightly convex ridges in the uplands. These soils formed in 30 to 60 inches of silty and clayey lacustrine sediment and the underlying loamy glacial till. The native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Shorewood soils are similar to Nicollet soils and are commonly near Kilkenny and Minnetonka soils. Nicollet soils have less clay and more sand than Shorewood soils and do not have an argillic horizon. Kilkenny soils do not have a mollic epipedon and are on convex side slopes above Shorewood soils. Minnetonka soils are poorly drained and are in lower areas.

Typical pedon of Shorewood silty clay loam, 1 to 3 percent slopes, 176 feet west and 120 feet south of the northeast corner of the NW1/4 sec. 34, T. 96 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; black (10YR 2/1) light silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; slightly acid; clear smooth boundary.

A12—8 to 16 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; black (10YR 2/1) coatings on peds; medium acid; gradual smooth boundary.

B21t—16 to 22 inches; mottled olive brown (2.5Y 4/4) and dark grayish brown (2.5Y 4/2) heavy silty clay loam; moderate fine subangular blocky structure; friable; few very dark grayish brown (10YR 3/2) coatings on peds; few very dark grayish brown (10YR 3/2) clay films on peds and in pores and root channels; medium acid; clear wavy boundary.

B22t—22 to 29 inches; mottled olive brown (2.5Y 4/4) and dark grayish brown (2.5Y 4/2) light silty clay; few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine and very fine subangular blocky structure; firm; discontinuous dark gray (10YR 4/1) clay films on peds and in pores and root channels; few fine dark reddish brown (5YR 2/2) oxides; medium acid; gradual smooth boundary.

B23t—29 to 37 inches; olive brown (2.5Y 4/4) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; nearly continuous grayish brown (2.5Y 5/2) coatings on peds; few patchy clay films in pores and root channels; common fine dark reddish brown (5YR 2/2) oxides; slightly acid; gradual smooth boundary.

B3t—37 to 44 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) silty clay loam that is high in sand; weak fine prismatic structure parting to weak medium subangular blocky; firm; discontinuous dark grayish brown (2.5Y 4/2) clay films on prisms; few fine dark reddish brown (5YR 2/2) oxides; neutral; gradual smooth boundary.

IIC—44 to 66 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) clay loam; massive; friable; few soft white (10YR 8/2) lime accumulations; slight effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates range from 28 to 45 inches. The mollic epipedon is 10 to 22 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is medium acid to neutral silty clay or silty clay loam. The B horizon has value of 3, 4, or 5 and chroma of 2 to 4. The B horizon is typically heavy silty clay loam or silty clay but in places is silt loam, light silty clay loam, loam, or clay loam below a depth of 30 inches. The B2t horizon ranges from slightly acid to strongly acid. The IIC horizon has value of 5 or 6 and chroma of 2 to 6. It is mildly alkaline or moderately alkaline.

Sogn series

The Sogn series consists of somewhat excessively drained, moderately permeable soils on escarpments of ridge crests on the uplands and stream benches. These soils formed in 4 to 20 inches of loamy sediment overlying limestone bedrock. The native vegetation was prairie grasses. Slope ranges from 2 to 18 percent.

These soils are taxadjuncts to the Sogn series because the climate in this county is wetter than is typical for Sogn soils. This difference does not alter the usefulness or behavior of the soils.

Sogn soils are similar to Rockton soils and are commonly near Kensett, Mottland, and Rockton soils. Kensett soils are somewhat poorly drained and have limestone bedrock at a depth of more than 24 inches. Kensett soils are below Sogn soils on the landscape. Mottland soils have material weathered from limestone at a depth of 7 to 20 inches. Rockton soils have limestone bedrock at a depth of more than 20 inches. Mottland and Rockton soils are above Sogn soils on the landscape.

Typical pedon of Sogn loam, 2 to 9 percent slopes, 1,080 feet west and 800 feet south of the northeast corner of the SE1/4NW1/4 sec. 1, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; dark brown (10YR 3/3) heavy loam, brown (10YR 4/3) dry; weak fine subangular blocky structure parting to weak fine granular; friable; dark grayish brown (10YR 3/2) coatings on peds; slightly acid; clear smooth boundary.

A12—8 to 11 inches; brown (10YR 4/3) and dark brown (10YR 3/3) heavy loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; friable; neutral; abrupt wavy boundary.

IIR—11 inches; hard shattered level-bedded limestone bedrock.

Thickness of the solum and depth to hard limestone range from 4 to 20 inches.

The A horizon has hue of 7.5YR and 10YR, value of 2 to 4, and chroma of 1 to 3. It is slightly acid to moderately alkaline loam to clay loam.

Sparta series

The Sparta series consists of excessively drained soils on uplands and stream benches. The upper part is moderately rapidly permeable, and the lower part is rapidly permeable. These soils formed in eolian sand or sandy alluvium that has been reworked by wind. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Sparta soils are similar to Dickinson soils and are commonly near Dickinson and Hoopeston soils. Dickinson soils have more clay and less sand in the solum than Sparta soils and are well drained and somewhat excessively drained. Hoopeston soils are somewhat poorly drained and are on concave side slopes below Sparta soils.

Typical pedon of Sparta loamy fine sand, 2 to 5 percent slopes, 500 feet north and 460 feet west of the southeast corner of the NE1/4 sec. 29, T. 94 N., R. 19 W., in a cultivated field:

Ap—0 to 7 inches; very dark brown (10YR 2/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

A12—7 to 13 inches; very dark brown (10YR 2/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak thick platy structure parting to weak fine granular; very friable; medium acid; clear smooth boundary.

A3—13 to 19 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure; very friable; medium acid; clear smooth boundary.

B2—19 to 25 inches; dark yellowish brown (10YR 4/4) loamy fine sand; weak coarse subangular blocky structure; very friable; medium acid; clear smooth boundary.

B3—25 to 35 inches; yellowish brown (10YR 5/4) fine sand; single grained; loose; slightly acid; gradual smooth boundary.

C1—35 to 50 inches; brown (10YR 5/3) fine sand; single grained; loose; slightly acid; gradual wavy boundary.

C2—50 to 60 inches; yellowish brown (10YR 5/4) fine sand; common fine faint yellowish brown (10YR 5/6) mottles; single grained; loose; neutral.

The solum ranges from 24 to 40 inches in thickness. The mollic epipedon ranges from 10 to 24 inches in thickness.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is typically loamy fine sand but in places is fine sand or loamy sand. The A horizon ranges from neutral to medium acid. The B horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is typically loamy fine sand but in places is loamy sand, sand, or fine sand. The B horizon is slightly acid to strongly acid. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6.

Storden series

The Storden series consists of well drained, moderately permeable soils on knobs and hills of glacial moraine uplands. These soils formed in calcareous loam glacial till of late Wisconsin age. The native vegetation was prairie grasses. Slope ranges from 5 to 18 percent.

Storden soils are similar to Clarion and Lester soils and are commonly near Clarion soils. Clarion and Lester soils are deeper to carbonates than Storden soils. Clarion soils have a thicker A horizon.

Typical pedon of Storden loam 9 to 14 percent slopes, severely eroded, 1,160 feet west and 620 feet north of the southeast corner of the SW1/4 sec. 10, T. 97 N., R. 22 W., in a cultivated field:

Ap—0 to 8 inches; mixed dark brown (10YR 3/3) and brown (10YR 4/3) loam, pale brown (10YR 5/3) dry; massive; friable; about 5 percent pebbles; strong effervescence; mildly alkaline; clear smooth boundary.

C—8 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; few strong brown (7.5YR 5/8) oxide concretions; about 5 percent pebbles; violent effervesence; mildly alkaline.

The thickness of the solum is commonly the same as the thickness of the A horizon. Free carbonates are in all horizons.

The A1 horizon in uncultivated areas is very dark brown (10YR 2/2) to dark brown (10YR 3/3) loam. The Ap horizon is dark brown (10YR 3/3) to brown (10YR 5/3) loam. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 6. It is mildly alkaline or moderately alkaline.

Talcot series

The Talcot series consists of poorly drained, calcareous soils on stream benches and in upland alluvial areas. These soils formed in 24 to 40 inches of moderately permeable loamy sediment over rapidly permeable sandy material. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 2 percent.

Talcot soils are similar to Harcot and Marshan soils and are commonly near Harcot soils. Harcot soils are moderately alkaline, and Marshan soils are neutral or slightly acid.

Typical pedon of Talcot clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, 111 feet south

and 95 feet east of the northwest corner of the SW1/4 sec. 15, T. 96 N., R. 21 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) light clay loam, black (10YR 2/1) dry; cloddy parting to weak fine granular structure; friable; few coarse sand grains; strong effervescence; mildly alkaline; clear smooth boundary.

A12—8 to 20 inches; black (N 2/0) light clay loam, black (10YR 2/1) dry; few fine distinct olive gray (5Y 5/2) mottles in lower 3 inches of horizon; weak fine granular structure; friable; few small strong brown (7.5YR 5/6) oxide concretions; strong effervescence; mildly alkaline; clear wavy boundary.

B2g—20 to 25 inches; mottled dark gray (5Y 4/1) and olive (5Y 4/3) light clay loam; weak medium subangular blocky structure; friable; few very dark gray (5Y 3/1) and dark gray (5Y 4/1) coatings on peds; few strong brown (7.5YR 5/6) oxide concretions; few small pebbles; mildly alkaline; strong effervescence; clear smooth boundary.

B3g—25 to 33 inches; mottled olive gray (5Y 5/2) and olive (5Y 5/3) loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few small pebbles; strong effervescence; mildly alkaline; clear smooth boundary.

IIC1—33 to 41 inches; yellowish brown (10YR 5/4) loamy sand; common medium distinct strong brown (7.5Y 5/6) mottles; single grained; loose; few pebbles; strong effervescence; mildly alkaline; gradual smooth boundary.

IIC2g—41 to 60 inches; light brownish gray (2.5Y 6/2) sand; few fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; strong effervescence; mildly alkaline.

Thickness of the solum and depth to the IIC horizon range from 24 to 40 inches. The mollic epipedon ranges from 14 to 24 inches in thickness.

The Ap horizon is black (10YR 2/1 or N 2/0). The A horizon is typically clay loam but in places is silty clay loam that is high in sand. The B2g horizon ranges from dark gray (N 4/0) to olive (5Y 5/3). It is clay loam or silty clay loam that is high in sand and is mildly alkaline. The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 2 to 6. It is stratified with sand, coarse sand, and gravel.

Terril series

The Terril series consists of moderately well drained, moderately permeable soils on slightly concave foot slopes and convex alluvial fans in the uplands. These soils formed in loamy local alluvial sediment. The native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Terril soils are similar to and are commonly near Coland soils. Coland soils are on bottom lands and are poorly drained.

Typical pedon of Terril loam, 2 to 5 percent slopes, 300 feet north and 110 feet east of the southwest corner of the NW1/4 sec. 3, T. 97 N., R. 22 W., in an uncultivated field:

A11—0 to 13 inches; black (10YR 2/1) loam, very dark brown (10YR 2/2) dry; moderate fine and very fine granular structure; friable; very few small pebbles; neutral; gradual smooth boundary.

A12—13 to 20 inches; black (10YR 2/1) heavy loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; very few small pebbles; neutral; gradual smooth boundary.

A3—20 to 30 inches; very dark brown (10YR 2/2) light clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky structure; friable; very few small pebbles; neutral; gradual smooth boundary.

B1—30 to 39 inches; dark brown (10YR 3/3) light clay loam, weak medium subangular blocky structure; friable; very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) coatings on peds; very few small pebbles; neutral; gradual smooth boundary.

B2—39 to 48 inches; dark yellowish brown (10YR 4/4) sandy clay loam; few fine distinct grayish brown (2.5Y 5/2) mottles; weak medium subangular blocky structure; friable; dark brown (10YR 3/3) coatings on peds; few small pebbles; neutral; gradual smooth boundary.

C1—48 to 56 inches; yellowish brown (10YR 5/4) heavy loam; common fine distinct grayish brown (2.5Y 5/2) mottles; massive; friable; few red (2.5YR 4/6) oxide concretions; few small pebbles; mildly alkaline; clear wavy boundary.

C2—56 to 74 inches; yellowish brown (10YR 5/6) heavy loam; many medium distinct grayish brown (2.5Y 5/2) mottles; massive; friable; few small pebbles; slight effervescence; mildly alkaline.

The solum ranges from about 36 to 60 inches in thickness. The mollic epipedon ranges from 24 to 40 inches in thickness.

The A horizon is typically black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The texture is typically loam but in places is clay loam or silt loam that is high in sand. The B1 horizon is dark brown (10YR 3/3) or brown (10YR 4/3) with darker coatings on the peds. The B2 horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6). Some pedons have faint mottles in the lower part of the B horizon or in the C horizon. The B horizon is commonly loam, sandy clay loam, or light clay loam. The solum is slightly acid or neutral. The C horizon is loam or light clay loam.

Tilfer series

The Tilfer series consists of poorly drained, moderately permeable soils on stream benches, in upland drainageways, and in a few places on first bottoms of streams. These soils formed in 20 to 40 inches of calcareous silty and loamy alluvial sediment overlying limestone bedrock. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 2 percent.

Tilfer soils are similar to Faxon soils and are commonly near Kensett and Talcot soils. Faxon soils do not have free carbonates throughout the surface layer. Kensett soils are on convex side slopes and are somewhat poorly drained. Talcot soils have a sand and gravel substratum.

Typical pedon of Tilfer silty clay loam, 0 to 2 percent slopes, 120 feet north and 196 feet east of the center of sec. 17, T. 97 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) light silty clay loam that is high in sand, black (10YR 2/1) dry; moderate fine granular structure; friable; strong effervescence; mildly alkaline; clear smooth boundary.

A12—8 to 13 inches; black (N 2/0) light silty clay loam that is high in sand, black (10YR 2/1) dry; weak medium subangular blocky parting to weak fine granular structure; friable; strong effervescence; mildly alkaline; clear smooth boundary.

A13—13 to 17 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; few fine distinct olive brown (5Y 5/2) mottles; weak fine subangular blocky structure; friable; very slight effervescence; mildly alkaline; clear wavy boundary.

B2g—17 to 23 inches; light olive gray (5Y 6/2) heavy loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few reddish brown (5YR 4/4) oxide concretions; mildly alkaline; clear smooth boundary.

B3g—23 to 29 inches; light olive gray (5Y 6/2) light silty clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; mildly alkaline; clear smooth boundary.

IICg—29 to 32 inches; light olive gray (5Y 6/2) gravelly sand; single grained; loose; estimated 20 percent gravel; mildly alkaline; strong effervescence; abrupt wavy boundary.

IIR—32 inches; fractured limestone bedrock.

Thickness of the solum and depth to hard, shattered limestone bedrock are typically 24 to 36 inches but range from 20 to 40 inches. The mollic epipedon ranges from 16 to 24 inches in thickness.

The A horizon is black (N 2/0 or 10YR 2/1) silty clay loam or clay loam. It is mildly alkaline or moderately alkaline. The B2g horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. It is loam, clay loam, or silty clay loam that is high in sand. The IIC or IIB3g horizon, where present, has hue of 10YR to 5Y, value of 5 or 6, and chroma of 2 to 6. It ranges from gravelly sand to loamy sand but commonly contains 10 to 30 percent pebbles and cobbles.

Tripoli series

The Tripoli series consists of poorly drained soils in broad areas on the uplands. These soils formed in 18 to 28 inches of moderately permeable surficial silty and loamy sediment and the underlying moderately permeable loamy glacial till. The native vegetation was prairie grasses that are tolerant to wetness. Slope ranges from 0 to 2 percent.

The Tripoli soils are similar to Kenyon and Readlyn and are commonly near Clyde and Readlyn soils. Clyde soils have thicker surficial loamy sediment and are along drainageways. Kenyon soils are moderately well drained. Readlyn soils are somewhat poorly drained and are on slightly convex side slopes above Tripoli soils.

Typical pedon of Tripoli silty clay loam, 0 to 2 percent slopes, 100 feet west of the southeast corner of the NE1/4 sec. 14, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) silty clay loam that is high in sand, black (10YR 2/1) dry; cloddy parting to weak fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 14 inches; black (N 2/0) silty clay loam that is high in sand, black (10YR 2/1) dry; weak fine granular structure; friable; neutral; clear wavy boundary.

A3g—14 to 18 inches; very dark gray (10YR 3/1) light silty clay loam that is high in sand, gray (10YR 5/1) dry; common fine distinct dark gray (5Y 4/1) mottles; weak fine subangular blocky structure; friable; very few small pebbles; mildly alkaline; clear wavy boundary.

B2g—18 to 24 inches; olive gray (5Y 5/2) light clay loam; weak fine subangular blocky structure; friable; few strong brown (7.5YR 5/6) oxide concretions; very few small pebbles; mildly alkaline; clear smooth boundary.

IIB3—24 to 36 inches; yellowish brown (10YR 5/4) heavy loam; common medium distinct light olive brown (2.5Y 6/4) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; friable; few pebbles; mildly alkaline; clear wavy boundary.

IIC—36 to 60 inches; strong brown (7.5YR 5/6) heavy loam; common fine distinct pale brown (10YR 6/3) mottles; massive; firm; few pebbles; strong effervescence; mildly alkaline.

Thickness of the solum and depth to carbonates are typically 3 to 4 feet. The mollic epipedon is 15 to 22 inches thick.

The Ap or A1 horizon is black (N 2/0 or 10YR 2/1) silty clay loam that is high in sand or clay loam. It is

neutral or mildly alkaline. The B1g or B2g horizon is dark gray (10YR 4/1) to olive gray (5Y 5/2) clay loam or silty clay loam that is high in sand. This horizon has high-chroma mottles. The IIB and IIC horizons are typically loam but range to sandy clay loam and clay loam.

Wapsie series

The Wapsie series consists of well drained soils on stream benches and on the uplands. Permeability is moderate in the subsoil and very rapid in the substratum. These soils formed in 24 to 32 inches of loamy sediment and the underlying sand and gravel. The native vegetation was mixed deciduous trees and prairie grasses. Slope ranges from 0 to 9 percent.

Wapsie soils are similar to Hayfield and Saude soils and are commonly near those soils. Hayfield soils are somewhat poorly drained and are in concave areas below Wapsie soils. Saude soils have a thicker dark colored A horizon than Wapsie soils.

Typical pedon of Wapsie loam, 2 to 5 percent slopes, 1,003 feet east and 630 feet south of the northwest corner of the NE1/4 sec. 6, T. 97 N., R. 21 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; neutral; abrupt smooth boundary.

B1—8 to 16 inches; brown (10YR 4/3) loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; very dark brown (10YR 2/2) coatings on peds; medium acid; clear wavy boundary.

B21t—16 to 23 inches; dark yellowish brown (10YR 4/4) loam; moderate fine subangular blocky structure; friable; dark yellowish brown (10YR 3/4) coatings on peds; thin discontinuous clay films; medium acid; clear smooth boundary.

B22t—23 to 28 inches; dark yellowish brown (10YR 4/4) loam; weak fine prismatic structure parting to weak medium subangular blocky; friable; dark yellowish brown (10YR 3/4) coatings on peds; thin continuous clay films; few pebbles; medium acid; abrupt wavy boundary.

IIB3t—28 to 31 inches; dark brown (7.5YR 4/4) sandy loam; weak coarse subangular blocky structure; very friable; clay bridging between sand grains; medium acid; abrupt wavy boundary.

IIC—31 to 60 inches; brown (7.5YR 4/4) gravelly loamy sand; single grained; loose; neutral; abrupt wavy boundary.

Thickness of the solum is typically 24 to 40 inches and ranges from 18 to 44 inches. Depth to gravelly loamy sand, gravelly sand, or sand is typically 24 to 32 inches and ranges from 18 to 36 inches. The surface layer typically has mollic colors to a depth of 8 inches.

The Ap or A1 horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). It ranges from loam to silt loam that is high in sand. The A2 horizon, where present, ranges from dark grayish brown (10YR 4/2) to brown (10YR 4/3) and from loam to silt loam that has a high content of sand. The B horizon ranges from brown (10YR 4/3 or 7.5YR 4/4) to yellowish brown (10YR 5/6). It ranges from sandy loam to loam or sandy clay loam in the upper part to sandy loam and gravelly loamy sand in the lower part. The IIB and IIC horizons are typically medium acid or strongly acid, but in some pedons the IIC horizon is neutral or slightly acid.

Waukee series

The Waukee series consists of well drained soils on stream benches and on the uplands. These soils formed in 30 to 40 inches of moderately permeable loamy alluvial sediment and the underlying very rapidly permeable sand and gravel. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Waukee soils are similar to and are commonly near Lawler and Saude soils. Lawler soils are somewhat poorly drained and are in concave areas below Waukee soils. Saude soils have less clay in the upper part of the B horizon and are less deep to coarse sand and gravel than Waukee soils.

Typical pedon of Waukee loam, 0 to 2 percent slopes, 463 feet west and 265 feet north of the southeast corner of sec. 25, T. 96 N., R. 19 W., in a cultivated field:

Ap—0 to 8 inches; very dark brown (10YR 2/2) heavy loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; black (10YR 2/1) coatings on peds; slightly acid; clear smooth boundary.

A12—8 to 14 inches; very dark brown (10YR 2/2) heavy loam, dark grayish brown (10YR 4/2) dry; weak fine and very fine granular structure; friable; black (10YR 2/1) coatings on peds; medium acid; clear smooth boundary.

A3—14 to 18 inches; dark brown (10YR 3/3) heavy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; very dark brown (10YR 2/2) coatings on peds; medium acid; clear wavy boundary.

B1—18 to 23 inches; brown (10YR 4/3) heavy loam; weak fine subangular blocky structure; friable; dark brown (10YR 3/3) coatings on peds; medium acid; clear smooth boundary.

B2—23 to 34 inches; dark yellowish brown (10YR 4/4) heavy loam; weak medium subangular blocky structure; friable; brown (10YR 4/3) coatings on peds; medium acid; clear smooth boundary.

IIC1—34 to 60 inches; dark yellowish brown (10YR 4/4) loamy coarse sand; single grained; loose; few small pebbles; medium acid; gradual smooth boundary.

IIC2—60 to 72 inches; brown (10YR 4/3) coarse sand; single grained; loose; estimated 6 percent fine gravel; slightly acid.

The solum typically is 30 to 48 inches thick. Depth to sand and gravel is 30 to 40 inches. Depth to carbonates typically is 72 inches or more.

The A1 or Ap horizon is black (10YR 2/1) or very dark brown (10YR 2/2) loam or silt loam that is high in sand. The B horizon has hue of 10YR and less commonly hue of 7.5YR; value is 4 or 5 and chroma is 3 to 6. Texture is loam or sandy clay loam. The lower part of the A horizon and the B horizon are medium acid or strongly acid. The IIC horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It ranges from loamy sand to gravelly sand and is slightly acid or medium acid.

Webster series

The Webster series consists of poorly drained, moderately permeable soils on the uplands. These soils formed in glacial till and local alluvium derived from glacial till. The native vegetation was prairie. Slope ranges from 0 to 2 percent.

Webster soils are similar to and are near Canisteo and Nicollet soils. Canisteo soils are mildly alkaline in the solum. Nicollet soils are somewhat poorly drained and are on slightly concave side slopes above Webster soils.

Typical pedon of Webster silty clay loam, 0 to 2 percent slopes, 133 feet north and 170 feet east of the southwest corner of the SE1/4 sec. 2, T. 95 N., R. 21 W., in a cultivated field:

Ap—0 to 8 inches; black (N 2/0) light silty clay loam that is high in sand, black (10YR 2/1) dry; moderate medium granular structure; friable; neutral; clear smooth boundary.

A12—8 to 17 inches; black (N 2/0) light silty clay loam that is high in sand, black (10YR 2/1) dry; moderate fine granular structure; friable; neutral; clear wavy boundary.

B1—17 to 23 inches; very dark gray (10YR 3/1) light silty clay loam; common medium distinct dark grayish brown (2.5Y 4/2) mottles; weak fine subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

B2g—23 to 30 inches; mottled olive gray (5Y 5/2) and dark gray (5Y 4/1) light clay loam; weak fine subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

B3g—30 to 37 inches; olive gray (5Y 5/2) light silty clay loam that is high in sand; weak medium subangular blocky structure; friable; few small lime concretions; thin discontinuous lenses of sandy loam; slight effervescence; mildly alkaline; gradual smooth boundary.

Cg—37 to 60 inches; light olive gray (5Y 6/2) light clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few small lime concretions in upper part of horizon; thin discontinuous lenses of sandy loam; violent effervescence; moderately alkaline.

The thickness of the solum is generally 24 to 40 inches but is as much as 50 inches in some pedons. The depth to free carbonates is generally about the same as the thickness of the solum; however, in many pedons the B3 horizon contains free carbonates. The mollic epipedon ranges from 14 to 24 inches in thickness.

The Ap or A1 horizon is black (N 2/0 or 10YR 2/1) clay loam or silty clay loam that is high in sand. The A horizon is neutral. Below the A horizon, color value increases from 3 to 5 as depth increases. The B2 and B3 horizons have hue of 5Y or 2.5Y, value of 4 or 5, and chroma of 1 or 2. They are typically clay loam or silty clay loam that is high in sand. The B2 and B3 horizons are neutral or mildly alkaline. The Cg horizon ranges from light olive gray (5Y 6/2) with few mottles to mottled yellowish brown (10YR 5/8) and grayish brown (2.5Y 5/2). The Cg horizon is typically loam or clay loam but ranges to sandy loam and silty clay loam that is high in sand. In some pedons there are thin strata of silty or sandy material. The Cg horizon is mildly alkaline or moderately alkaline.

formation of the soils

This section describes the factors of soil formation and relates these factors to the soils in Cerro Gordo County. The formation of soils involves many steps and processes, all of which are important (*3*).

Soil is formed by processes of the environment acting on soil material that has been deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, or lay of the land, the length of time the forces of soil formation have acted on the soil material, and man's influence.

Climate and vegetation are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of parent material into a soil profile. It may be much or little, but some time is required for horizon differentiation. Generally a long period is required for the development of distinct horizons. Man's influence on the soil is also important.

The factors of soil formation are so closely interrelated that few generalizations can be made regarding any one factor unless conditions are specified for the others. Many of the processes of soil formation are unknown.

parent material

The accumulation of parent material is the first step in soil formation. Some of the soils in the county formed in weathered bedrock, but most of the soils formed in material that had been transported by glacial ice, water, wind, or gravity and redeposited at a new location.

The principal parent materials in Cerro Gordo County are glacial drift, loess, alluvium, and wind-deposited sand. Much less extensive as parent materials are organic deposits and residuum from bedrock.

Glacial drift is all rock material, including glacial till, that was transported and deposited by glacial ice and all material of dominantly glacial origin deposited in the sea or in bodies of glacial melt water. Glacial till is unsorted sediment. Its particles range in size from boulders to clay. Till is the most extensive parent material in Cerro Gordo County.

At least twice during the glacial period, continental ice (glaciers) moved over the entire county. The record of these ice invasions is contained in the unconsolidated mineral material that was deposited by the melting ice and melt-water streams.

The older ice sheet, the Nebraskan, was in Cerro Gordo County 750,000 years ago (*4*). It was followed by the Aftonian Interglacial Stage. The Kansan Glaciation started about 500,000 years ago.

An Iowan Substage of the Wisconsin Glaciation was recognized (*5*), but recent studies of the presence and indentification of Iowan glacial till indicate that the conclusions of studies made before 1960 are questionable (*7*). Intensive detailed geomorphic and stratigraphic work shows that the landscape is a multilevel sequence of erosion surfaces and that many of the levels are cut into Kansan and Nebraskan till. An "Iowan Till" does not exist, but an erosion-surface complex does exist in the Iowan region (*9*).

The Iowan surface is arranged in a series of steps from major drainageways toward boundary divides. A stone line marks where the Iowan surface cuts Kansan and Nebraskan till. The stone line occurs on all levels of the stepped surfaces, and it passes under the alluvium along the drainageways.

The Cary Glaciation was a substage of the Wisconsin Glaciation and occurred between about 13,000 and 14,000 years ago, the time decreasing from east to northwest (*7, 5*). The evidence for the geological recentness of the Cary Glaciation is the lack of deep weathering, the unleached calcareous till at a shallow depth, and the poorly developed surface drainage and many closed depressions. The Cary Drift (*9*) covers that area west of a line that runs generally from Interstate 35 at the north county line to the airport to 2 miles east of Burchinal to Swaledale.

In Bassett, Clyde, Donnan, Cerlin, Floyd, Kenyon, Oran, Readlyn, and Schley soils, glacial drift and glacial till on the Iowan erosion surface is overlaid by loamy surficial sediment about 12 to 24 inches thick. The sediment is thicker in Clyde, Floyd, and Schley soils on the lower concave slopes and in waterways. A stone line or pebble band commonly separates the friable, loamy surficial sediment from the firm loam or clay loam glacial till. Donnan and Cerlin soils formed in loamy material and the clayey paleosol derived from glacial till.

Canisteo, Clarion, Harps, Kilkenny, Lester, Le Sueur, Nicollet, Okoboji, Rolfe, Storden, and Webster soils formed in the Cary Drift. Minnetonka, Shorewood, and some Kilkenny soils formed in lacustrine deposits within the Cary Drift area.

Loess is silty material deposited by wind. It consists mostly of silt and clay. It does not contain coarse sand or gravel because those particles are too large to be moved more than a short distance by wind, but it does contain small amounts of fine and very fine sand. The thickness of the loess is about 20 to 40 inches. Loess covers about 4 percent of Cerro Gordo County and is confined to the eastern half of the county. Dinsdale, Klinger, and Maxfield soils formed in loess and the underlying till.

Alluvium is material that was deposited by waters on flood plains and benches along streams and on upland outwash plains. The deposits comprise lenses and layers of sand, gravel, silt, and clay. The thickness of alluvial material is variable. In most places along the Shellrock and Winnebago Rivers and their tributaries, the material ranges from 24 inches to about 30 feet in thickness and is underlain by limestone bedrock. Along other streams and on the upland outwash plains most of the alluvial deposits range from 10 feet to more than 60 feet in thickness.

Some of the alluvial material has been transported only a short distance and has accumulated at the foot of the slope on which it originated. This material is called local alluvium, and it retains many characteristics of the soils from which it was eroded. Terril soils are on foot slopes and therefore have properties related to those of the soils upslope from which they receive sediment.

Calco, Coland, and Hanlon soils are on flood plains. These soils formed in medium textured and moderately coarse textured alluvium.

Flagler, Harcot, Hayfield, Hoopeston, Lawler, Marshan, Saude, Talcot, Wapsie, and Waukee soils are on stream benches and outwash plains. They formed in moderately coarse textured to moderately fine textured loamy material 20 to 40 inches thick that is underlain by sand or gravel. Raddle soils formed in about 48 to 60 inches of medium textured silty alluvium underlain by sand or gravel and are also on benches and outwash plains.

In Salida soils, sandy loam material ranging from less than 5 inches to 15 inches in thickness is underlain by gravelly sand or gravel.

Eolian material is sandy and loamy material deposited by wind. It consists of silt, fine and very fine sand, and a small amount of clay. Most of this material occurs as low mounds or dunes in the uplands and on the stream benches. The sand in these eolian deposits consists largely of quartz, which is highly resistant to weathering. It has not been altered appreciably since it was deposited. Bolan, Dickinson, Sparta, and Hoopeston soils formed in eolian material.

Limestone and dolomite are the most extensive sedimentary rocks in Cerro Gordo county. With the exception of a few outcrops, the bedrock is covered by glacial drift, loess, alluvium, eolian material, and organic deposits. The thickness of this cover ranges form 20 to 40 inches in soils that are strongly affected by the bedrock—namely Faxon, Kensett, Rockton, and Tilfer soils—to an estimated 100 to 250 feet in parts of the Cary Drift area. In only a few places do the soils influenced by limestone bedrock show evidence of limestone residuum. These soils are mostly along the Shellrock and Winnebago Rivers and are underlain by limestone or dolomite of the Shellrock and Cedar Valley Formations. Rossfield and Mottland soils are underlain by friable limestone of the Lime Creek, Sheffield, and Aplington Formations. Calamine and Jacwin soils formed in 20 to 40 inches of sediment over shale of the Lime Creek and Sheffield Formations.

Organic deposits consist of plant material that has accumulated in old lakebeds, hillside seepy areas, and drainageways that support a thick growth of water-tolerant plants. Organic soils occupy wet areas in the county where poor drainage has retarded the decay of plant remains so that the remains accumulate. In Cerro Gordo County the thickness of the organic material ranges from 16 inches to more than 10 feet. Houghton and Palms soils formed in organic material.

climate

Over the past at least 5,000 years, the soils of Cerro Gordo County have been forming under a midcontinental, subhumid climate. Between 5,000 and 16,000 years ago the climate was conducive to the growth of forest (*8, 14*). The morphology of most of the soils in the county indicates that they formed under the present climate, which is fairly uniform throughout the county. The climate is marked by wide seasonal extremes in temperature, and precipitation is distributed throughout the year.

Climate is a major factor in determining what soils develop from the various parent materials. The rate and intensity of hydrolysis, carbonation, oxidation, and other important chemical reactions in the soil are influenced by climate. Temperature, rainfall, relative humidity, and length of the frost-free period are important in determining the vegetation.

The influence of the general climate of the region is somewhat modified by the local conditions in or near the specific soil. For example, south-facing, dry, sandy soils have a local climate (microclimate) that is warmer and less humid than the average climate of nearby areas. Low-lying, poorly drained areas are wetter and colder than most areas around them. These contrasts account for some of the differences between soils within the same general climatic region.

plants and animals

All living organisms—plants, animals, bacteria, and fungi—are important in soil formation. The vegetation

chiefly determines the amount of organic matter, the color of the surface layer, and the amount of nutrients in the soil. Earthworms and other burrowing animals keep the soil open and porous. Bacteria and fungi decompose the vegetation, releasing nutrients for plants.

Most of the soils in Cerro Gordo County formed under prairie grasses or a mixture of prairie grasses and water-tolerant plants. Because the grasses have many roots and tops that decay on or in the soil, the soils have a thick, dark surface layer. Kenyon and Webster soils are examples.

The soils that formed under timber have a thinner, lighter surface layer. The organic matter, derived principally from leaves, is deposited only on the surface of the soil. A number of soils in the county formed at first under prairie grasses and then under trees that replaced the grass. These soils are intermediate between grassland soils and forest soils. Lester and Bassett soils are examples.

Clarion and Lester soils formed in the same kind of parent material and under comparable environments except for native vegetation. Clarion soils, which formed under prairie, have a thicker and darker surface layer than Lester soils, which formed under mixed prairie and forest. The differences in native vegetation account for the main differences in morphology between these soils.

relief

Relief is an important cause of differences among soils. Indirectly it influences soil formation through its effect on drainage. In Cerro Gordo County the relief ranges from level to steep. Many nearly level areas are frequently flooded and have a high or periodically high water table. On stronger slopes, much of the rainfall runs off.

In general, soils that form where the water table is high or periodically high have a dominantly olive-gray subsoil like that of Canisteo, Clyde, Marshan, and Webster soils. Those that formed where the water table is below the subsoil have a yellowish-brown subsoil like that of Clarion, Kenyon, and Lester soils. Floyd, Readlyn, Oran, and Lawler soils formed where natural drainage is intermediate, and their subsoil is grayish brown and mottled. Of soils that formed under prairie grasses, those that have a high water table generally have more organic matter in the surface layer than those that have good natural drainage.

Aspect, as well as gradient, has a significant influence on soil formation. South-facing slopes generally are warmer and drier than north-facing slopes and consequently support grasses, whereas north-facing slopes support trees.

The influence of a porous, rapidly permeable parent material may override the influence of topography. Sparta soils, for example, are no more than moderately sloping. Yet they are excessively drained because of their rapid permeability.

Maxfield, Klinger, and Dinsdale soils formed in the same kind of parent material and under similar vegetation but differ because of different positions. Maxfield soils are on broad, nearly level upland flats. Klinger soils are on broad, nearly level ridges and long, very gently sloping side slopes. Dinsdale soils are on nearly level ridge crests and gently sloping side slopes. Topography influences the drainage of these soils, so that Dinsdale soils are moderately well drained, Klinger soils are somewhat poorly drained, and Maxfield soils are poorly drained.

time

Time is necessary for soil formation to take place. The time ranges from a few days to form soils in fresh alluvial deposits to thousands of years to develop the paleosol that makes up the subsoil of Donnan soils. As soils continue to weather, the texture of the subsoil generally becomes finer and a greater amount of soluble material is leached out. Exceptions to this rule are soils that formed in quartz sand, such as Sparta soils, or in other materials that are resistant to weathering. Such soils do not change much over long periods. Other exceptions are steep soils that have slow water infiltration and produce a large amount of runoff. Such soils weather more slowly than soils in stable, less sloping positions.

The loess that covers the eastern parts of Cerro Gordo County in which Dinsdale and Klinger soils formed is probably about 14,000 to 20,000 years old (*8*). The maximum age for these soils on stable summits would be 14,000 years (*6, 7*). The Iowan erosion surfaces formed during the deposition of loess between 14,000 and 30,000 years ago (*9*). The Iowan surface, where covered by loam sediment, is younger than 14,000 years. In the loamy and silty overburden of this erosional surface formed 30 percent of the soils in the county, including Bassett, Dinsdale, Franklin, Kenyon, Klinger, Maxfield, Oran, and Readlyn soils. Floyd, Clyde, and Schley soils are younger, and they are cut in and below these higher lying soils.

Some of the soils in Cerro Gordo County are as young as 2,000 to 6,000 years (*9*). Youth perhaps accounts for the weakly developed profile of Nicollet, Webster, Floyd, and Clyde soils.

Time is needed for soil formation, but the age of the parent material does not necessarily reflect the true age of the soil that formed in that material. Erosion removes soil material, so soils that form in less stable, eroded areas may be younger than soils that form on stable upland summits, even though their parent materials are the same age.

man's influence on the soil

Important changes take place in the soil when it is drained and cultivated. Some of these changes have little effect on soil productivity; others have drastic

effects. Changes caused by erosion generally are the most apparent. On many of the cultivated soils in the county, particularly the steeper ones, part or all of the original surface layer has been lost through accelerated sheet erosion. Even in fields that are not eroded, the compaction of the soil by heavy machinery during cultivation reduces the thickness of the surface layer.

Man has done much to increase productivity of the soils and to reclaim areas not suitable for crops. For example, commercial fertilizers have been used to make the soil more productive. Many areas have been artificially drained, lowering the water table sufficiently for row crops.

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glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) up to 38.1 centimeters (15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. Tillage that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the

greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002

millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any part of the A horizon not directly at the surface.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-73 at Mason City, Iowa]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F		In	In	In		In
January----	21.9	3.9	12.9	44	-25	0	0.77	0.25	1.17	3	7.2
February---	27.7	9.6	18.7	49	-19	0	.90	.25	1.42	3	7.3
March------	37.4	20.1	28.8	69	-9	17	1.72	.84	2.42	5	9.5
April------	56.2	35.0	45.6	87	16	45	2.58	1.26	3.65	6	1.4
May--------	69.3	46.4	57.9	91	26	264	3.95	2.68	5.11	8	.0
June-------	79.1	56.7	67.9	97	41	537	4.86	2.22	7.00	8	.0
July-------	82.2	60.7	71.4	95	46	663	4.44	2.30	6.18	8	.0
August-----	81.1	58.7	69.9	96	43	617	3.38	1.67	4.77	6	.0
September--	71.8	48.9	60.3	91	30	309	3.40	1.07	5.25	6	.0
October----	61.7	38.9	50.4	86	18	141	1.99	.63	3.09	4	.0
November---	43.1	24.6	33.8	69	-2	7	1.21	.35	1.90	3	2.7
December---	28.0	11.7	19.9	56	-22	0	1.03	.45	1.49	4	8.4
Year-----	55.0	34.6	44.8	98	-26	2,600	30.23	23.47	36.58	64	36.5

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-73 at Mason City, Iowa]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 24	May 9	May 19
2 years in 10 later than--	April 20	May 4	May 14
5 years in 10 later than--	April 11	April 24	May 5
First freezing temperature in fall:			
1 year in 10 earlier than--	October 11	September 28	September 20
2 years in 10 earlier than--	October 15	October 4	September 25
5 years in 10 earlier than--	October 25	October 14	October 5

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-73 at Mason City, Iowa]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	177	151	133
8 years in 10	184	158	140
5 years in 10	196	172	153
2 years in 10	208	186	166
1 year in 10	214	193	173

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
6	Okoboji silty clay loam, 0 to 1 percent slopes	5,550	1.5
27B	Terril loam, 2 to 5 percent slopes	1,225	0.3
29	Clarion-Nicollet loams, 1 to 3 percent slopes	755	0.2
41B	Sparta loamy fine sand, 2 to 5 percent slopes	230	*
41C	Sparta loamy fine sand, 5 to 9 percent slopes	330	0.1
55	Nicollet loam, 1 to 3 percent slopes	8,375	2.3
62C3	Storden loam, 5 to 9 percent slopes, severely eroded	500	0.1
62D3	Storden loam, 9 to 14 percent slopes, severely eroded	1,750	0.5
62E3	Storden loam, 14 to 18 percent slopes, severely eroded	990	0.3
73C	Salida sandy loam, 2 to 9 percent slopes	590	0.2
73E	Salida sandy loam, 9 to 18 percent slopes	390	0.1
83	Kenyon loam, 0 to 2 percent slopes	1,595	0.4
83B	Kenyon loam, 2 to 5 percent slopes	21,650	5.9
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	330	0.1
84	Clyde silty clay loam, 0 to 2 percent slopes	30,995	8.4
95	Harps loam, 1 to 3 percent slopes	14,025	3.8
107	Webster silty clay loam, 0 to 2 percent slopes	28,225	7.7
135	Coland clay loam, 0 to 2 percent slopes	6,500	1.8
138	Clarion loam, 0 to 2 percent slopes	380	0.1
138B	Clarion loam, 2 to 5 percent slopes	23,490	6.4
138C	Clarion loam, 5 to 9 percent slopes	415	0.1
138C2	Clarion loam, 5 to 9 percent slopes, moderately eroded	7,500	2.0
138D2	Clarion loam, 9 to 14 percent slopes, moderately eroded	570	0.2
151	Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	1,850	0.5
152	Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	5,725	1.6
153	Shandep clay loam, 0 to 1 percent slopes	310	0.1
169B	Clarion loam, 2 to 5 percent long slopes	2,125	0.6
171	Bassett loam, 0 to 2 percent slopes	255	0.1
171B	Bassett loam, 2 to 5 percent slopes	2,575	0.7
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded	220	*
171D2	Bassett loam, 9 to 14 percent slopes, moderately eroded	200	*
171F	Bassett loam, 14 to 25 percent slopes	225	*
173	Hoopeston fine sandy loam, 1 to 3 percent slopes	1,000	0.3
174	Bolan loam, 0 to 2 percent slopes	670	0.2
174B	Bolan loam, 2 to 5 percent slopes	2,175	0.6
175	Dickinson fine sandy loam, 0 to 2 percent slopes	205	*
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	1,100	0.3
177	Saude loam, 0 to 2 percent slopes	13,500	3.7
177B	Saude loam, 2 to 5 percent slopes	6,925	1.9
177C	Saude loam, 5 to 9 percent slopes	260	0.1
177C2	Saude loam, 5 to 9 percent slopes, moderately eroded	230	*
178	Waukee loam, 0 to 2 percent slopes	3,325	0.9
178B	Waukee loam, 2 to 5 percent slopes	800	0.2
184	Klinger silty clay loam, 1 to 3 percent slopes	4,075	1.1
188	Kensett loam, 0 to 2 percent slopes	1,090	0.3
198B	Floyd loam, 1 to 4 percent slopes	19,205	5.3
201B	Coland-Terril complex, 1 to 4 percent slopes	585	0.2
213	Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes	1,350	0.4
213B	Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes	4,050	1.1
214	Rockton loam, 20 to 30 inches to limestone, 0 to 2 percent slopes	700	0.2
214B	Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes	4,000	1.1
214C	Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes	430	0.1
216B	Ripon silt loam, 20 to 30 inches to limestone, 1 to 5 percent slopes	595	0.2
217	Ripon silt loam, 30 to 40 inches to limestone, 0 to 2 percent slopes	1,200	0.3
217B	Ripon silt loam, 30 to 40 inches to limestone, 2 to 5 percent slopes	295	0.1
221	Palms muck, 0 to 1 percent slopes	1,365	0.4
221B	Palms muck, 1 to 4 percent slopes	215	*
225	Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	1,500	0.4
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	3,825	1.0
236B	Lester loam, 2 to 5 percent slopes	6,615	1.8
236C	Lester loam, 5 to 9 percent slopes	430	0.1
236C2	Lester loam, 5 to 9 percent slopes, moderately eroded	9,500	2.6
236D2	Lester loam, 9 to 14 percent slopes, moderately eroded	4,115	1.1
236E2	Lester loam, 14 to 18 percent slopes, moderately eroded	650	0.2
236F	Lester loam, 18 to 25 percent slopes	555	0.2
274	Rolfe silt loam, 0 to 1 percent slopes	180	*
284	Flagler sandy loam, 0 to 2 percent slopes	295	0.1
284B	Flagler sandy loam, 2 to 5 percent slopes	885	0.3
284C	Flagler sandy loam, 5 to 9 percent slopes	545	0.1
325	Le Sueur loam, 1 to 3 percent slopes	230	*

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
329	Webster-Nicollet complex, 1 to 3 percent slopes	5,875	1.6
335	Harcot loam, 0 to 2 percent slopes	2,325	0.6
354	Aquolls and Histosols	1,650	0.4
377	Dinsdale silty clay loam, 0 to 2 percent slopes	1,875	0.5
377B	Dinsdale silty clay loam, 2 to 5 percent slopes	3,150	0.9
382	Maxfield silty clay loam, 0 to 2 percent slopes	2,700	0.7
391B	Clyde-Floyd complex, 1 to 4 percent slopes	990	0.3
398	Tripoli silty clay loam, 0 to 2 percent slopes	1,625	0.4
399	Readlyn loam, 1 to 3 percent slopes	10,300	2.8
407B	Schley loam, 1 to 4 percent slopes	1,675	0.5
412C	Sogn loam, 2 to 9 percent slopes	3,150	0.9
412E	Sogn loam, 9 to 18 percent slopes	290	0.1
444	Jacwin silty clay loam, 1 to 3 percent slopes	820	0.2
457	Du Page silt loam, 0 to 2 percent slopes	255	0.1
471	Oran silt loam, 1 to 3 percent slopes	2,825	0.8
507	Canisteo silty clay loam, 0 to 2 percent slopes	10,575	2.9
536	Hanlon fine sandy loam, 0 to 2 percent slopes	250	*
551	Calamine silty clay loam, 1 to 3 percent slopes	1,415	0.4
558	Talcot clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	830	0.2
559	Talcot clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	2,575	0.7
583	Minnetonka silty clay loam, 0 to 2 percent slopes	635	0.2
611	Rossfield Variant silty clay loam, 1 to 3 percent slopes	650	0.2
612B	Mottland loam, 2 to 5 percent slopes	445	0.1
612C2	Mottland loam, 5 to 9 percent slopes moderately eroded	1,025	0.3
612E2	Mottland loam, 9 to 18 percent slopes, moderately eroded	470	0.1
612G2	Mottland loam, 18 to 40 percent slopes, moderately eroded	165	*
613	Rossfield silt loam, 0 to 2 percent slopes	2,105	0.6
613B	Rossfield silt loam, 2 to 5 percent slopes	3,235	0.9
613C	Rossfield silt loam, 5 to 9 percent slopes	285	0.1
614B	Jacwin Variant loam, 2 to 5 percent slopes	630	0.2
614C3	Jacwin Variant silty clay loam, 5 to 9 percent slopes, severely eroded	220	0.1
621	Houghton muck, 0 to 1 percent slopes	1,510	0.4
638C2	Clarion-Storden loams, 5 to 9 percent slopes, moderately eroded	1,200	0.3
638D2	Clarion-Storden loams, 9 to 14 percent slopes, moderately eroded	970	0.3
651	Faxon silty clay loam, 0 to 2 percent slopes	1,170	0.3
695	Tilfer silty clay loam, 0 to 2 percent slopes	835	0.2
706	Cerlin silt loam, 0 to 2 percent slopes	750	0.2
706B	Cerlin silt loam, 2 to 5 percent slopes	1,585	0.4
725	Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	695	0.2
733	Calco silty clay loam, 0 to 2 percent slopes	1,250	0.3
755	Nicollet loam, 1 to 3 percent long slopes	1,540	0.4
777	Wapsie loam, 0 to 2 percent slopes	375	0.1
777B	Wapsie loam, 2 to 5 percent slopes	1,200	0.3
777C2	Wapsie loam, 5 to 9 percent slopes, moderately eroded	350	0.1
782	Donnan loam, 0 to 2 percent slopes	605	0.2
782B	Donnan loam, 2 to 5 percent slopes	2,825	0.8
782C2	Donnan loam, 5 to 9 percent slopes, moderately eroded	250	*
836B	Kilkenny clay loam, 2 to 5 percent slopes	535	0.1
836C2	Kilkenny clay loam, 5 to 9 percent slopes, moderately eroded	585	0.2
855	Shorewood silty clay loam, 1 to 3 percent slopes	395	0.1
936	Coland-Hanlon complex, 0 to 2 percent slopes	1,600	0.4
956	Okoboji-Harps complex, 0 to 3 percent slopes	5,125	1.4
976	Raddle silt loam, 1 to 3 percent slopes	375	0.1
1936	Coland-Hanlon complex, channeled, 0 to 2 percent slopes	850	0.2
5010	Pits, sand and gravel	610	0.2
5030	Pits, limestone quarry	705	0.2
5040	Orthents, loamy	2,135	0.6
5060	Pits, clay	205	*
	Water	4,318	1.2
	Water, sewage lagoon	50	*
	Total	368,128	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
6----------------------- Okoboji	84	32	67	3.3	3.4	7.3	4.3
27B--------------------- Terril	118	45	94	4.2	5.0	8.3	7.0
29---------------------- Clarion-Nicollet	114	41	85	3.9	4.6	7.2	6.7
41B--------------------- Sparta	60	23	47	2.0	2.5	4.1	3.6
41C--------------------- Sparta	54	21	42	2.0	2.0	3.3	3.0
55---------------------- Nicollet	120	45	93	4.2	5.0	8.3	7.0
62C3-------------------- Storden	86	33	68	3.3	3.5	6.0	5.2
62D3-------------------- Storden	77	29	62	2.7	3.2	5.3	4.6
62E3-------------------- Storden	60	23	40	2.5	3.0	4.5	3.6
73C--------------------- Salida	35	15	25	1.2	1.6	2.5	2.1
73E--------------------- Salida	---	---	---	1.0	1.2	2.0	1.5
83---------------------- Kenyon	115	44	92	4.2	4.8	8.0	6.8
83B--------------------- Kenyon	113	43	90	4.2	4.7	7.8	6.6
83C2-------------------- Kenyon	105	40	84	3.8	4.4	7.3	6.3
84---------------------- Clyde	108	41	86	6.6	4.3	7.3	5.5
95---------------------- Harps	95	36	76	3.3	4.0	6.6	5.0
107--------------------- Webster	110	42	88	4.2	4.4	7.3	6.6
135--------------------- Coland	100	38	80	4.1	4.2	7.0	6.0
138--------------------- Clarion	112	43	90	4.2	4.7	7.8	6.7
138B-------------------- Clarion	110	42	88	4.2	4.6	7.6	6.7
138C-------------------- Clarion	105	40	84	3.8	4.4	7.3	6.3
138C2------------------- Clarion	102	39	82	3.8	4.3	7.1	6.2

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
138D2 Clarion	93	35	74	3.7	3.9	6.5	5.5
151 Marshan	91	35	73	3.7	3.8	6.3	4.8
152 Marshan	101	38	81	4.2	4.0	6.7	5.3
153 Shandep	85	32	68	3.3	3.4	5.6	---
169B Clarion	117	44	94	4.2	4.9	8.1	7.0
171 Bassett	107	40	85	4.0	4.5	7.5	6.5
171B Bassett	107	40	85	4.0	4.5	7.5	6.5
171C2 Bassett	99	38	80	3.5	4.0	6.6	6.0
171D2 Bassett	90	34	72	3.2	3.8	6.3	5.3
171F Bassett	---	---	---	2.5	---	4.5	4.1
173 Hoopeston	90	33	70	3.3	4.1	6.8	5.6
174 Bolan	90	34	72	3.6	3.8	6.3	5.3
174B Bolan	88	33	70	3.6	3.7	6.1	5.2
175 Dickinson	83	32	62	2.7	3.0	5.0	5.0
175B Dickinson	81	31	60	2.7	3.0	5.0	4.8
177 Saude	78	30	62	3.0	3.3	5.5	4.6
177B Saude	76	29	61	3.0	3.2	5.3	4.5
177C Saude	71	27	57	2.8	3.0	5.0	4.3
177C2 Saude	68	26	54	2.7	2.8	4.6	4.1
178 Waukee	98	37	78	4.0	4.1	6.8	5.8
178B Waukee	96	36	77	4.0	4.0	6.6	5.6
184 Klinger	123	46	92	4.2	5.1	8.5	7.3
188 Kensett	85	32	68	3.6	3.6	6.0	5.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
198B------------------- Floyd	110	40	90	4.1	4.5	7.5	6.9
201B------------------- Coland-Terril	---	---	---	3.5	4.8	7.8	6.4
213-------------------- Rockton	100	38	80	3.8	4.2	7.0	6.0
213B------------------- Rockton	96	36	77	3.6	4.0	6.6	5.6
214-------------------- Rockton	78	30	62	2.6	3.2	5.1	4.7
214B------------------- Rockton	76	29	60	2.6	3.0	5.0	4.5
214C------------------- Rockton	71	27	57	2.5	2.8	4.6	4.2
216B------------------- Ripon	85	32	85	3.1	3.6	6.0	5.0
217-------------------- Ripon	107	41	86	4.0	4.5	7.5	6.3
217B------------------- Ripon	105	40	84	3.8	4.4	7.3	6.2
221-------------------- Palms	80	30	65	3.3	3.4	5.3	4.8
221B------------------- Palms	75	28	61	3.1	3.0	5.0	4.4
225-------------------- Lawler	85	32	68	3.7	3.6	6.0	5.0
226-------------------- Lawler	100	38	80	4.0	4.2	7.0	6.0
236B------------------- Lester	105	35	80	3.5	4.5	6.5	6.3
236C------------------- Lester	95	33	75	3.5	4.5	6.5	5.9
236C2------------------ Lester	92	35	74	3.5	3.9	6.5	5.4
236D2------------------ Lester	83	32	66	3.3	3.5	5.8	5.0
236E2------------------ Lester	70	28	60	2.9	2.9	4.8	4.0
236F------------------- Lester	---	---	---	3.0	2.0	3.3	2.7
274-------------------- Rolfe	86	33	69	3.3	3.0	5.0	4.5
284-------------------- Flagler	63	24	47	2.3	3.0	5.0	4.3
284B------------------- Flagler	61	23	46	2.1	2.9	4.8	4.1

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
284C----------------------- Flagler	56	21	42	1.7	2.7	4.5	3.8
325------------------------ Le Sueur	112	43	90	3.3	4.5	6.7	6.3
329------------------------ Webster-Nicollet	114	41	85	3.9	4.4	7.0	6.3
335------------------------ Harcot	80	30	64	3.1	3.2	6.0	4.8
354**. Aquolls and Histosols							
377------------------------ Dinsdale	123	47	91	4.2	5.2	8.6	7.4
377B----------------------- Dinsdale	119	45	89	4.1	5.0	8.3	7.1
382------------------------ Maxfield	119	45	89	4.2	5.0	8.3	6.6
391B----------------------- Clyde-Floyd	104	40	84	5.4	4.3	7.1	6.3
398------------------------ Tripoli	111	42	89	4.1	4.5	7.5	6.5
399------------------------ Readlyn	115	44	92	4.2	4.8	8.0	7.0
407B----------------------- Schley	100	38	80	4.0	4.2	7.0	6.0
412C, 412E----------------- Sogn	---	---	---	1.2	1.2	2.0	1.5
444------------------------ Jacwin	85	32	68	3.0	3.4	5.6	5.0
457------------------------ Du Page	92	36	74	3.6	3.8	5.6	5.3
471------------------------ Oran	109	41	87	4.0	4.6	7.6	6.5
507------------------------ Canisteo	110	40	84	4.0	4.2	7.0	6.0
536------------------------ Hanlon	90	34	72	3.3	3.8	6.3	5.3
551------------------------ Calamine	95	32	75	4.0	4.0	5.8	5.1
558------------------------ Talcot	85	32	68	3.2	3.4	5.8	4.9
559------------------------ Talcot	95	36	76	3.3	4.0	6.3	5.4
583------------------------ Minnetonka	90	36	75	3.1	4.0	6.0	5.3
611------------------------ Rossfield Variant	110	42	88	4.1	4.6	7.6	6.6

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
612B----------------------- Mottland	90	34	72	3.6	3.8	6.3	5.3
612C2---------------------- Mottland	80	30	64	3.3	3.4	5.6	4.8
612E2---------------------- Mottland	50	19	40	1.6	2.1	3.5	3.0
612G2---------------------- Mottland	---	---	---	1.2	---	---	---
613------------------------ Rossfield	105	40	84	4.0	4.4	7.3	6.3
613B----------------------- Rossfield	103	39	82	3.8	4.3	7.1	6.1
613C----------------------- Rossfield	98	37	78	3.6	4.1	6.8	5.8
614B----------------------- Jacwin Variant	90	33	68	3.1	3.4	5.6	5.0
614C3---------------------- Jacwin Variant	50	19	40	1.6	2.1	3.5	3.0
621------------------------ Houghton	70	27	56	2.7	2.8	4.3	4.0
638C2---------------------- Clarion-Storden	90	32	68	3.4	3.9	6.2	5.8
638D2---------------------- Clarion-Storden	85	30	63	3.4	3.7	5.8	5.1
651------------------------ Faxon	80	30	65	3.3	3.0	3.5	4.8
695------------------------ Tilfer	85	32	68	3.4	3.6	5.6	5.0
706------------------------ Cerlin	82	31	66	3.3	3.4	5.6	4.8
706B----------------------- Cerlin	78	30	62	3.1	3.3	5.5	4.6
725------------------------ Hayfield	79	30	63	3.0	3.0	5.0	4.2
733------------------------ Calco	99	38	84	4.2	4.2	7.0	5.3
755------------------------ Nicollet	123	46	98	4.3	5.1	8.5	7.3
777------------------------ Wapsie	72	27	57	2.7	3.0	5.0	4.3
777B----------------------- Wapsie	70	27	56	2.6	2.9	4.8	4.1
777C2---------------------- Wapsie	65	25	52	2.3	2.7	4.5	3.8
782------------------------ Donnan	72	26	58	2.8	2.9	4.8	3.6

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Kentucky bluegrass	Grass-legume hay	Bromegrass-alfalfa	Smooth bromegrass
	Bu	Bu	Bu	AUM*	Ton	AUM*	AUM*
782B: Donnan	70	24	56	2.7	2.8	4.6	3.5
782C2: Donnan	60	22	48	2.3	2.4	4.0	2.9
836B: Kilkenny	90	34	75	3.5	3.8	6.3	5.4
836C2: Kilkenny	75	28	60	3.0	3.2	5.3	4.5
855: Shorewood	105	39	84	3.8	4.5	6.7	6.3
936: Coland-Hanlon	95	36	76	3.9	4.0	6.7	5.8
956: Okoboji-Harps	90	34	72	3.4	3.7	6.1	4.7
976: Raddle	122	45	98	4.1	5.8	8.3	7.1
1936: Coland-Hanlon	---	---	---	3.1	4.4	6.7	5.8
5010**, 5030**. Pits							
5040**. Orthents							
5060**. Pits							

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	42,090	---	---	---
II	233,080	68,735	142,015	22,330
III	74,180	55,235	18,445	500
IV	6,630	2,330	---	4,300
V	1,140	---	850	290
VI	1,170	780	---	390
VII	1,915	165	1,750	---
VIII	---	---	---	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
41B, 41C Sparta	2s	Slight	Slight	Severe	Slight	Northern red oak	70	Eastern white pine, red pine, jack pine.
						Red pine	---	
						Eastern white pine	---	
						Jack pine	---	
171, 171B, 171C2, 171D2 Bassett	3o	Slight	Slight	Slight	Slight	White oak	55	Eastern white pine, red pine, European larch, black walnut, sugar maple.
						Northern red oak	55	
171F Bassett	3r	Moderate	Moderate	Slight	Slight	White oak	55	Eastern white pine, northern red oak, red pine, white oak.
						Northern red oak	55	
221, 221B Palms	3w	Slight	Severe	Severe	Severe	White ash	51	
						Red maple	51	
						Black willow	---	
						Silver maple	76	
236B, 236C, 236C2, 236D2 Lester	2o	Slight	Slight	Slight	Slight	Northern red oak	69	Black walnut, northern red oak, American basswood, silver maple, white oak, eastern cottonwood.
						American basswood	69	
						Black walnut	62	
						Eastern cottonwood	92	
						Eastern white pine	64	
						White oak	62	
236E2, 236F Lester	2r	Moderate	Moderate	Slight	Slight	Northern red oak	69	Black walnut, northern red oak, American basswood, silver maple, white oak.
						American basswood	69	
						Black walnut	62	
						Eastern cottonwood	92	
						Eastern white pine	64	
						White oak	62	
325 Le Sueur	2o	Slight	Slight	Slight	Slight	Sugar maple	60	Black walnut, eastern cottonwood, American basswood.
						American basswood	70	
						Black walnut	55	
						Eastern cottonwood	85	
407B Schley	3o	Slight	Slight	Slight	Slight	White oak	55	Eastern white pine, red pine, European larch, sugar maple.
						Northern red oak	55	
471 Oran	3o	Slight	Slight	Slight	Slight	White oak	55	Eastern white pine, red pine, European larch, black walnut, sugar maple.
						Northern red oak	55	
536 Hanlon	3o	Slight	Slight	Slight	Slight	Northern red oak	55	Eastern white pine, red pine, European larch, black walnut, sugar maple.
						White oak	55	
551 Calamine	4w	Slight	Severe	Severe	Severe	Silver maple	70	Silver maple, white ash.
						White ash	---	
583 Minnetonka	3w	Slight	Moderate	Moderate	Moderate	Eastern cottonwood	90	Eastern cottonwood, green ash.
						Green ash	52	
						Black ash	52	
621 Houghton	3w	Slight	Severe	Severe	Severe	White ash	51	
						Red maple	51	
						Black willow	---	
						Silver maple	76	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
725: Hayfield	2o	Slight	Slight	Slight	Slight	Northern red oak White oak Eastern white pine	63 63 58	Northern red oak, white oak, silver maple, eastern white pine.
777, 777B, 777C2: Wapsie	3o	Slight	Slight	Slight	Slight	Northern red oak White oak	55 55	Eastern white pine, red pine, European larch, black walnut, sugar maple.
782, 782B, 782C2: Donnan	3o	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, European larch, black walnut, sugar maple.
836B, 836C2: Kilkenny	2o	Slight	Slight	Slight	Slight	Northern red oak Black walnut American basswood	65 68 68	Black walnut, eastern white pine, northern red oak, white oak.
855: Shorewood	2c	Slight	Slight	Slight	Moderate	Eastern cottonwood American basswood Black walnut Sugar maple	85 70 60 60	Eastern cottonwood, American basswood, eastern white pine.
936*: Coland.								
Hanlon	3o	Slight	Slight	Slight	Slight	Northern red oak White oak	55 55	Eastern white pine, red pine, European larch, sugar maple.
1936*: Coland.								
Hanlon	3o	Slight	Slight	Slight	Slight	Northern red oak White oak	55 55	Eastern white pine, red pine, European larch, black walnut, sugar maple.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
6. Okoboji	Common ninebark, redosier dogwood.	Tatarian honeysuckle, silky dogwood, autumn-olive.	Norway spruce, Amur maple, Zabel honeysuckle, northern white-cedar.	Green ash	Silver maple, eastern cottonwood.
27B. Terril	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Amur maple, eastern redcedar.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
29*:					
Clarion	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
Nicollet	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Ponderosa pine, eastern white pine, green ash, common hackberry.	Silver maple.
41B, 41C. Sparta	American plum, common ninebark.	Tatarian honeysuckle, lilac, autumn-olive.	Austrian pine, common hackberry.	Eastern white pine, red pine, jack pine.	---
55. Nicollet	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Ponderosa pine, eastern white pine, green ash, common hackberry.	Silver maple.
62C3, 62D3. Storden	Common ninebark, gray dogwood.	Tatarian honeysuckle, Siberian peashrub, northern white-cedar.	Eastern redcedar, white spruce.	Green ash, Russian-olive.	---
62E3. Storden					
73C. Salida	Lilac	Eastern redcedar, northern white-cedar, bur oak, Russian-olive, Tatarian honeysuckle, Siberian peashrub.	Common hackberry, red pine, Scotch pine, white spruce, jack pine.	---	---
73E. Salida					
83, 83B, 83C2. Kenyon	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
84----------------- Clyde	Silky dogwood-----	Redosier dogwood, American plum, Tatarian honeysuckle, eastern redcedar, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
95---------------- Harps	Gray dogwood------	Tatarian honeysuckle, redosier dogwood, common ninebark, Siberian peashrub.	Laurel willow, northern white-cedar, white spruce.	Green ash, golden willow, black willow.	Eastern cottonwood.
107--------------- Webster	Redosier dogwood, gray dogwood, silky dogwood.	Zabel honeysuckle, Tatarian honeysuckle, American plum.	Laurel willow, northern white-cedar, Amur maple.	Green ash---------	Silver maple, eastern cottonwood.
135--------------- Coland	Common ninebark, indiancurrant coralberry.	Redosier dogwood, Tatarian honeysuckle, silky dogwood, Zabel honeysuckle.	White spruce, northern white-cedar, Amur maple.	Green ash---------	Eastern cottonwood, silver maple.
138, 138B, 138C, 138C2, 138D2----- Clarion	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
151, 152---------- Marshan	Common ninebark, gray dogwood.	Redosier dogwood, northern white-cedar, American plum, Tatarian honeysuckle.	Amur maple, white spruce.	Golden willow, common hackberry, green ash.	Silver maple, eastern cottonwood.
153--------------- Shandep	Silky dogwood-----	Redosier dogwood, American plum, Tatarian honeysuckle, eastern redcedar, Zabel honeysuckle.	Northern white-cedar, laurel willow, Amur maple.	Green ash---------	Eastern cottonwood, silver maple.
169B-------------- Clarion	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
171, 171B, 171C2, 171D2, 171F------ Bassett	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
173--------------- Hoopeston	Gray dogwood, silky dogwood.	Siberian crabapple, Tatarian honeysuckle, Siberian peashrub, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, ponderosa pine, Scotch pine.	Green ash---------	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
174, 174B--------- Bolan	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
175, 175B--------- Dickinson	Silky dogwood, gray dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
177, 177B, 177C, 177C2------------ Saude	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
178, 178B--------- Waukee	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum.	Amur maple, eastern redcedar.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
184--------------- Klinger	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
188--------------- Kensett	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
198B-------------- Floyd	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
201B*:					
Coland-----------	Common ninebark, indiancurrant coralberry.	Redosier dogwood, Tatarian honeysuckle, silky dogwood, Zabel honeysuckle.	White spruce, northern white-cedar, Amur maple.	Green ash---------	Eastern cottonwood, silver maple.
Terril-----------	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Amur maple, eastern redcedar.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
213, 213B--------- Rockton	Gray dogwood, Siberian peashrub.	Autumn-olive, silky dogwood, Amur honeysuckle, lilac, Tatarian honeysuckle.	Eastern redcedar, Russian-olive.	Eastern white pine, Austrian pine, red pine.	---
214, 214B, 214C--- Rockton	Gray dogwood, Siberian peashrub.	Autumn-olive, silky dogwood, Amur honeysuckle, lilac, Tatarian honeysuckle.	Eastern redcedar, Russian-olive.	Eastern white pine, Austrian pine, red pine.	---
216B, 217, 217B--- Ripon	Gray dogwood, Siberian peashrub.	Silky dogwood, Amur honeysuckle, autumn-olive, lilac, Tatarian honeysuckle.	Eastern redcedar, Russian-olive.	Austrian pine, eastern white pine, red pine.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
221, 221B: Palms	Gray dogwood, common ninebark.	Amur honeysuckle, silky dogwood, nannyberry viburnum, Amur privet.	Northern white-cedar, tall purple willow, Siberian crabapple.	Golden willow, black willow.	Carolina poplar.
225, 226: Lawler	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Silver maple, eastern cottonwood.
236B, 236C, 236C2, 236D2: Lester	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, Siberian crabapple, Amur maple, white spruce.	Eastern white pine, green ash, common hackberry, Scotch pine.	Silver maple.
236E2, 236F. Lester					
274: Rolfe	Redosier dogwood, silky dogwood.	Zabel honeysuckle, Tatarian honeysuckle.	Laurel willow, Amur maple, northern white-cedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
284, 284B, 284C: Flagler	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
325: Le Sueur	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Scotch pine, eastern white pine, green ash, common hackberry.	Silver maple.
329*:					
Webster	Redosier dogwood, gray dogwood, silky dogwood.	Zabel honeysuckle, Tatarian honeysuckle, American plum.	Laurel willow, northern white-cedar, Amur maple.	Green ash	Silver maple, eastern cottonwood.
Nicollet	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Ponderosa pine, eastern white pine, green ash, common hackberry.	Silver maple.
335: Harcot	Silky dogwood	Redosier dogwood, Tatarian honeysuckle, eastern redcedar, Zabel honeysuckle, American plum.	Laurel willow, northern white-cedar, Amur maple.	Green ash	Eastern cottonwood, silver maple.
354*:					
Aquolls.					
Histosols.					
377, 377B: Dinsdale	Gray dogwood, silky dogwood.	Redosier dogwood, Amur honeysuckle, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
382--------------- Maxfield	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum.	Laurel willow, Amur maple, Zabel honeysuckle, northern white-cedar.	Green ash---------	Silver maple, eastern cottonwood.
391B*:					
Clyde------------	Silky dogwood-----	Redosier dogwood, American plum, Tatarian honeysuckle, eastern redcedar, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
Floyd------------	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
398--------------- Tripoli	Silky dogwood-----	Redosier dogwood, American plum, Tatarian honeysuckle, autumn-olive, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
399--------------- Readlyn	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
407B-------------- Schley	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
412C, 412E. Sogn					
444--------------- Jacwin	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
457--------------- Du Page	---	Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, white spruce, northern white-cedar, Russian-olive.	Golden willow, green ash, common hackberry, bur oak, ponderosa pine, black willow.	---
471--------------- Oran	Silky dogwood, gray dogwood.	Redosier dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
507--------------- Canisteo	---	Tatarian honeysuckle, Siberian peashrub.	White spruce, Russian-olive, eastern redcedar, northern white-cedar.	Common hackberry, green ash, bur oak, golden willow, black willow.	Eastern cottonwood.
536--------------- Hanlon	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
551----------------Calamine	Common ninebark, gray dogwood.	Redosier dogwood, Tatarian honeysuckle.	Russian-olive, eastern redcedar, green ash, commom hackberry, bur oak.	Golden willow, black willow.	Eastern cottonwood.
558, 559----------Talcot	Common ninebark---	Amur honeysuckle, redosier dogwood, Tatarian honeysuckle.	Russian-olive, northern white-cedar.	Green ash, golden willow, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
583----------------Minnetonka	Common ninebark---	Northern white-cedar, Tatarian honeysuckle, lilac.	White spruce, Amur maple, tall purple willow.	Norway spruce, silver maple, green ash, golden willow.	Eastern cottonwood.
611----------------Rossfield Variant	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
612B, 612C2, 612E2, 612G2-----Mottland	Common ninebark, lilac.	Autumn-olive, Siberian peashrub.	Russian-olive, northern white-cedar, Austrian pine, eastern redcedar.	Ponderosa pine, common hackberry.	Green ash.
613, 613B, 613C---Rossfield	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
614B, 614C3-------Jacwin Variant	Gray dogwood, silky dogwood.	Tatarian honeysuckle, American plum, redosier dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
621----------------Houghton	Gray dogwood, common ninebark.	Amur honeysuckle, silky dogwood, nannyberry viburnum, Amur privet.	Northern white-cedar, tall purple willow, Siberian crabapple.	Golden willow, black willow.	Carolina poplar.
638C2*, 638D2*:					
Clarion-----------	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
Storden-----------	Common ninebark, gray dogwood.	Tatarian honeysuckle, Siberian peashrub, northern white-cedar.	Eastern redcedar, white spruce, tall purple willow.	Green ash, Russian-olive.	---
651----------------Faxon	Common ninebark---	Tatarian honeysuckle, northern white-cedar, redosier dogwood, American plum.	Amur maple, white spruce.	Golden willow, common hackberry, green ash.	Eastern cottonwood, silver maple.
695----------------Tilfer	Gray dogwood, common ninebark.	Lilac, autumn-olive, Siberian peashrub, Tatarian honeysuckle.	Amur maple, nannyberry viburnum, eastern redcedar.	Silver maple, golden willow.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
706, 706B--------- Cerlin	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Norway spruce, Amur maple.	Red pine, common hackberry.	Eastern cottonwood, silver maple.
725--------------- Hayfield	Gray dogwood, silky dogwood.	Tatarian honeysuckle, lilac, Siberian crabapple, American plum.	Eastern redcedar, bur oak, northern white-cedar, Russian-olive, common hackberry, white spruce.	Green ash---------	Silver maple.
733--------------- Calco	Silky dogwood-----	Redosier dogwood, eastern redcedar, Tatarian honeysuckle, American plum, Zabel honeysuckle.	Laurel willow, Amur maple, northern white-cedar.	Green ash---------	Silver maple, eastern cottonwood.
755--------------- Nicollet	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Ponderosa pine, eastern white pine, green ash, common hackberry.	Silver maple.
777, 777B, 777C2-- Wapsie	Redosier dogwood, gray dogwood.	Lilac, Tatarian honeysuckle, common chokecherry.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry, eastern white pine.	Silver maple.
782, 782B, 782C2-- Donnan	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Blue spruce, eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
836B, 836C2------- Kilkenny	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple, eastern redcedar.	Red pine, eastern white pine, green ash, common hackberry.	Eastern cottonwood.
855--------------- Shorewood	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple, eastern redcedar.	Red pine, eastern white pine, green ash, common hackberry.	Eastern cottonwood.
936*:					
Coland-----------	Common ninebark, indiancurrant coralberry.	Redosier dogwood, Tatarian honeysuckle, silky dogwood, Zabel honeysuckle.	White spruce, northern white-cedar, Amur maple.	Green ash---------	Eastern cottonwood, silver maple.
Hanlon-----------	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
956*:					
Okoboji----------	Common ninebark, redosier dogwood.	Tatarian honeysuckle, silky dogwood, autumn-olive.	Norway spruce, Amur maple, Zabel honeysuckle, northern white-cedar.	Green ash---------	Silver maple, eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
956*:					
Harps	Gray dogwood	Tatarian honeysuckle, redosier dogwood, common ninebark, Siberian peashrub.	Laurel willow, northern white-cedar, white spruce.	Green ash, golden willow, black willow.	Eastern cottonwood.
976 Raddle	Redosier dogwood, gray dogwood.	Autumn-olive, silky dogwood, Amur honeysuckle.	Amur maple, Russian-olive.	Eastern white pine, Norway spruce.	Eastern cottonwood, American sycamore, silver maple.
1936*:					
Coland	Common ninebark, indiancurrant coralberry.	Redosier dogwood, Tatarian honeysuckle, silky dogwood, Zabel honeysuckle.	White spruce, northern white-cedar, Amur maple.	Green ash	Eastern cottonwood, silver maple.
Hanlon	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
5010*, 5030*. Pits					
5040*. Orthents					
5060*. Pits					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
6 Okoboji	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, erodes easily.	Severe: ponding.
27B Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
29*:					
Clarion	Slight	Slight	Moderate: slope.	Slight	Slight.
Nicollet	Slight	Slight	Moderate: slope.	Slight	Slight.
41B Sparta	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
41C Sparta	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
55 Nicollet	Slight	Slight	Moderate: slope.	Slight	Slight.
62C3 Storden	Slight	Slight	Severe: slope.	Slight	Slight.
62D3 Storden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
62E3 Storden	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
73C Salida	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Severe: droughty.
73E Salida	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Severe: droughty.
83 Kenyon	Slight	Slight	Slight	Slight	Slight.
83B Kenyon	Slight	Slight	Moderate: slope.	Slight	Slight.
83C2 Kenyon	Slight	Slight	Severe: slope.	Slight	Slight.
84 Clyde	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: floods, wetness.	Moderate: wetness, floods.	Severe: floods.
95 Harps	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
107 Webster	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
135 Coland	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
138: Clarion	Slight	Slight	Slight	Slight	Slight.
138B: Clarion	Slight	Slight	Moderate: slope.	Slight	Slight.
138C, 138C2: Clarion	Slight	Slight	Severe: slope.	Slight	Slight.
138D2: Clarion	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
151, 152: Marshan	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
153: Shandep	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
169B: Clarion	Slight	Slight	Moderate: slope.	Slight	Slight.
171: Bassett	Slight	Slight	Slight	Slight	Slight.
171B: Bassett	Slight	Slight	Moderate: slope.	Slight	Slight.
171C2: Bassett	Slight	Slight	Severe: slope.	Slight	Slight.
171D2: Bassett	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
171F: Bassett	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
173: Hoopeston	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
174: Bolan	Slight	Slight	Slight	Slight	Slight.
174B: Bolan	Slight	Slight	Moderate: slope.	Slight	Slight.
175: Dickinson	Slight	Slight	Slight	Slight	Slight.
175B: Dickinson	Slight	Slight	Moderate: slope.	Slight	Slight.
177: Saude	Slight	Slight	Slight	Slight	Slight.
177B: Saude	Slight	Slight	Moderate: slope.	Slight	Slight.
177C, 177C2: Saude	Slight	Slight	Severe: slope.	Slight	Slight.
178: Waukee	Slight	Slight	Slight	Slight	Slight.
178B: Waukee	Slight	Slight	Moderate: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
184 Klinger	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
188 Kensett	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Moderate: thin layer.
198B Floyd	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
201B*:					
Coland	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods.
Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
213 Rockton	Slight	Slight	Slight	Slight	Moderate: thin layer.
213B Rockton	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: thin layer.
214 Rockton	Slight	Slight	Slight	Slight	Moderate: thin layer.
214B Rockton	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: thin layer.
214C Rockton	Slight	Slight	Severe: slope.	Slight	Moderate: thin layer.
216B Ripon	Slight	Slight	Moderate: depth to rock, slope.	Slight	Moderate: thin layer.
217 Ripon	Slight	Slight	Slight	Slight	Moderate: thin layer.
217B Ripon	Slight	Slight	Moderate: depth to rock, slope.	Slight	Moderate: thin layer.
221, 221B Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
225, 226 Lawler	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
236B Lester	Slight	Slight	Moderate: slope.	Slight	Slight.
236C, 236C2 Lester	Slight	Slight	Severe: slope.	Slight	Slight.
236D2 Lester	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
236E2, 236F Lester	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
274 Rolfe	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
284 Flagler	Slight	Slight	Slight	Slight	Slight.
284B Flagler	Slight	Slight	Moderate: slope.	Slight	Slight.
284C Flagler	Slight	Slight	Severe: slope.	Slight	Slight.
325 Le Sueur	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
329*:					
Webster	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Nicollet	Slight	Slight	Moderate: slope.	Slight	Slight.
335 Harcot	Severe: floods, wetness, excess humus.	Severe: excess humus.	Severe: excess humus, wetness.	Severe: excess humus.	Moderate: wetness.
354*:					
Aquolls.					
Histosols.					
377 Dinsdale	Slight	Slight	Slight	Slight	Slight.
377B Dinsdale	Slight	Slight	Moderate: slope.	Slight	Slight.
382 Maxfield	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
391B*:					
Clyde	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: floods, wetness.	Moderate: wetness, floods.	Severe: floods.
Floyd	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
398 Tripoli	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
399 Readlyn	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
407B Schley	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
412C Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
412E Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight	Severe: thin layer.
444 Jacwin	Severe: percs slowly, excess humus.	Severe: excess humus, percs slowly.	Severe: excess humus, percs slowly.	Severe: excess humus.	Moderate: thin layer.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
457------------------- Du Page	Severe: floods.	Slight----------	Moderate: floods.	Slight------------	Moderate: floods.
471------------------- Oran	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight------------	Slight.
507------------------- Canisteo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
536------------------- Hanlon	Severe: floods.	Slight----------	Moderate: floods.	Slight------------	Moderate: floods.
551------------------- Calamine	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
558, 559-------------- Talcot	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
583------------------- Minnetonka	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
611------------------- Rossfield Variant	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, depth to rock.	Slight------------	Moderate: thin layer.
612B------------------ Mottland	Slight----------	Slight----------	Moderate: slope, small stones.	Slight------------	Moderate: large stones.
612C2----------------- Mottland	Slight----------	Slight----------	Severe: slope.	Slight------------	Moderate: large stones.
612E2----------------- Mottland	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: large stones, slope.
612G2----------------- Mottland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
613------------------- Rossfield	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
613B------------------ Rossfield	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
613C------------------ Rossfield	Slight----------	Slight----------	Severe: slope.	Slight------------	Slight.
614B------------------ Jacwin Variant	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight------------	Slight.
614C3----------------- Jacwin Variant	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight------------	Slight.
621------------------- Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
638C2*:					
Clarion--------------	Slight----------	Slight----------	Severe: slope.	Slight------------	Slight.
Storden--------------	Slight----------	Slight----------	Severe: slope.	Slight------------	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
638D2*:					
Clarion	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Storden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
651 Faxon	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
695 Tilfer	Severe: floods, wetness, excess humus.	Severe: excess humus.	Severe: excess humus, wetness.	Severe: excess humus.	Moderate: wetness, floods, thin layer.
706, 706B Cerlin	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
725 Hayfield	Slight	Slight	Slight	Slight	Slight.
733 Calco	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: floods, wetness.
755 Nicollet	Slight	Slight	Moderate: slope.	Slight	Slight.
777 Wapsie	Slight	Slight	Slight	Slight	Slight.
777B Wapsie	Slight	Slight	Moderate: slope.	Slight	Slight.
777C2 Wapsie	Slight	Slight	Severe: slope.	Slight	Slight.
782, 782B Donnan	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
782C2 Donnan	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly, slope.	Slight	Slight.
836B Kilkenny	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
836C2 Kilkenny	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
855 Shorewood	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
936*:					
Coland	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
Hanlon	Severe: floods.	Slight	Moderate: floods.	Slight	Moderate: floods.
956*:					
Okoboji	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, erodes easily.	Severe: ponding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
956*:					
Harps	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
976 Raddle	Slight	Slight	Slight	Slight	Slight.
1936*:					
Coland	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods.
Hanlon	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
5010*, 5030*. Pits					
5040*. Orthents					
5060*. Pits					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
6: Okoboji	Fair	Fair	Fair	Fair	Very poor.	Good	Good	Fair	Fair	Good.
27B: Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
29*:										
Clarion	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Nicollet	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
41B: Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
41C: Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
55: Nicollet	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
62C3, 62D3, 62E3: Storden	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
73C: Salida	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
73E: Salida	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
83, 83B: Kenyon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
83C2: Kenyon	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
84: Clyde	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
95: Harps	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
107: Webster	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
135: Coland	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
138, 138B: Clarion	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
138C, 138C2, 138D2: Clarion	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
151, 152: Marshan	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
153: Shandep	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
169B: Clarion	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
171, 171B: Bassett	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
171C2, 171D2: Bassett	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
171F: Bassett	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
173: Hoopeston	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
174, 174B: Bolan	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
175, 175B: Dickinson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
177, 177B: Saude	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
177C, 177C2: Saude	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
178, 178B: Waukee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
184: Klinger	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
188: Kensett	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
198B: Floyd	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
201B*:										
Coland	Poor	Fair	Fair	Poor	Poor	Good	Good	Poor	Poor	Good.
Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
213, 213B, 214, 214B, 214C: Rockton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
216B, 217, 217B: Ripon	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
221, 221B: Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
225, 226: Lawler	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
236B: Lester	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
236C, 236C2, 236D2, 236E2: Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
236F: Lester	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
274: Rolfe	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
284, 284B----------Flagler	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
284C---------------Flagler	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
325----------------Le Sueur	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
329*:										
Webster-----------	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
Nicollet----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
335----------------Harcot	Good	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
354*:										
Aquolls.										
Histosols.										
377, 377B----------Dinsdale	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
382----------------Maxfield	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
391B*:										
Clyde-------------	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
Floyd-------------	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
398----------------Tripoli	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
399----------------Readlyn	Good	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
407B---------------Schley	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
412C, 412E---------Sogn	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
444----------------Jacwin	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
457----------------Du Page	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
471----------------Oran	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
507----------------Canisteo	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
536----------------Hanlon	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
551----------------Calamine	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
558, 559-----------Talcot	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
583---------------- Minnetonka	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
611---------------- Rossfield Variant	Good	Fair	Good	Good	Fair	Good	Good	Good	Good	Good.
612B--------------- Mottland	Fair	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.
612C2, 612E2------- Mottland	Poor	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Very poor.	Very poor.
612G2-------------- Mottland	Very poor	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
613, 613B---------- Rossfield	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
613C--------------- Rossfield	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
614B--------------- Jacwin Variant	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
614C3-------------- Jacwin Variant	Poor	Poor	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor.
621---------------- Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
638C2*, 638D2*:										
Clarion-----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Storden-----------	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
651---------------- Faxon	Fair	Fair	Fair	Poor	Poor	Good	Fair	Fair	Poor	Fair.
695---------------- Tilfer	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
706, 706B---------- Cerlin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
725---------------- Hayfield	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
733---------------- Calco	Good	Fair	Good	Poor	Very poor.	Good	Good	Fair	Poor	Fair.
755---------------- Nicollet	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
777, 777B---------- Wapsie	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
777C2-------------- Wapsie	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
782, 782B---------- Donnan	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
782C2-------------- Donnan	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
836B----------------- Kilkenny	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
836C2---------------- Kilkenny	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
855------------------ Shorewood	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
936*:										
Coland-------------	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
Hanlon-------------	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
956*:										
Okoboji------------	Fair	Fair	Fair	Fair	Very poor.	Good	Good	Fair	Fair	Good.
Harps--------------	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
976------------------ Raddle	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
1936*:										
Coland-------------	Poor	Fair	Fair	Poor	Poor	Good	Good	Poor	Poor	Good.
Hanlon-------------	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
5010*, 5030*. Pits										
5040*. Orthents										
5060*. Pits										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
6: Okoboji	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
27B: Terril	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
29*:						
Clarion	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
Nicollet	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
41B: Sparta	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
41C: Sparta	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
55: Nicollet	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
62C3: Storden	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
62D3: Storden	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
62E3: Storden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
73C: Salida	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
73E: Salida	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
83, 83B: Kenyon	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
83C2: Kenyon	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
84: Clyde	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, floods, frost action.	Severe: floods.
95: Harps	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
107: Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
135: Coland	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, frost action.	Moderate: wetness, floods.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
138, 138B: Clarion	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
138C, 138C2: Clarion	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
138D2: Clarion	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
151, 152: Marshan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
153: Shandep	Severe: wetness, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: floods, wetness.
169B: Clarion	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
171, 171B: Bassett	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.	Slight.
171C2: Bassett	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.	Slight.
171D2: Bassett	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
171F: Bassett	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
173: Hoopeston	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
174, 174B: Bolan	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
175, 175B: Dickinson	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
177, 177B: Saude	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
177C, 177C2: Saude	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
178, 178B: Waukee	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.	Slight.
184: Klinger	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
188: Kensett	Severe: depth to rock, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness, depth to rock.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: thin layer.
198B: Floyd	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
201B*:						
Coland	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, frost action.	Severe: floods.
Terril	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
213, 213B, 214, 214B Rockton	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Moderate: thin layer.
214C Rockton	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Moderate: thin layer.
216B, 217, 217B Ripon	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: frost action, low strength.	Moderate: thin layer.
221, 221B Palms	Severe: excess humus, ponding.	Severe: ponding, low strength, floods.	Severe: ponding, low strength, floods.	Severe: ponding, floods, low strength.	Severe: ponding, floods, frost action.	Severe: ponding, floods, excess humus.
225, 226 Lawler	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
236B Lester	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
236C, 236C2 Lester	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
236D2 Lester	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
236E2, 236F Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
274 Rolfe	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
284 Flagler	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
284B, 284C Flagler	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
325 Le Sueur	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
329*:						
Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Nicollet	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
335 Harcot	Severe: cutbanks cave, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: frost action.	Moderate: wetness.
354*: Aquolls.						
Histosols.						
377, 377B Dinsdale	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
382 Maxfield	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
391B*: Clyde	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, floods, frost action.	Severe: floods.
Floyd	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: low strength, frost action.	Slight.
398 Tripoli	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
399 Readlyn	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action, low strength.	Slight.
407B Schley	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
412C Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
412E Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: thin layer.
444 Jacwin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: thin layer.
457 Du Page	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Moderate: floods.
471 Oran	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
507 Canisteo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
536 Hanlon	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
551 Calamine	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
558, 559 Talcot	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
583 Minnetonka	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, frost action.	Severe: wetness.
611 Rossfield Variant	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: thin layer.
612B Mottland	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.
612C2 Mottland	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: large stones.	Moderate: large stones.
612E2 Mottland	Moderate: large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, large stones.	Moderate: large stones, slope.
612G2 Mottland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
613, 613B Rossfield	Moderate: dense layer.	Slight	Slight	Slight	Severe: low strength.	Slight.
613C Rossfield	Moderate: dense layer.	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
614B Jacwin Variant	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
614C3 Jacwin Variant	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
621 Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
638C2*:						
Clarion	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Storden	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
638D2*:						
Clarion	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Storden	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
651 Faxon	Severe: depth to rock, wetness.	Severe: floods, wetness.	Severe: floods, wetness, depth to rock.	Severe: floods, wetness.	Severe: wetness, floods, frost action.	Severe: wetness.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
695 Tilfer	Severe: depth to rock, wetness.	Severe: floods, wetness.	Severe: floods, wetness, depth to rock.	Severe: floods, wetness.	Severe: floods, frost action.	Moderate: wetness, floods, thin layer.
706, 706B Cerlin	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
725 Hayfield	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.
733 Calco	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, floods.	Moderate: floods, wetness.
755 Nicollet	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
777, 777B Wapsie	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
777C2 Wapsie	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
782, 782B, 782C2 Donnan	Moderate: wetness, too clayey.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell, frost action.	Slight.
836B Kilkenny	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
836C2 Kilkenny	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
855 Shorewood	Moderate: too clayey, wetness.	Severe: shrink-swell.	Moderate: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, frost action, shrink-swell.	Slight.
936*:						
Coland	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, frost action.	Moderate: wetness, floods.
Hanlon	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
956*:						
Okoboji	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
Harps	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
976 Raddle	Slight	Slight	Slight	Slight	Severe: frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1936*:						
Coland	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, frost action.	Severe: floods.
Hanlon	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
5010*, 5030*. Pits						
5040*. Orthents						
5060*. Pits						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
6------------------ Okoboji	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: hard to pack, ponding.
27B---------------- Terril	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
29*:					
Clarion-----------	Slight-----------	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.
Nicollet----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
41B---------------- Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
41C---------------- Sparta	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
55----------------- Nicollet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
62C3--------------- Storden	Slight-----------	Severe: slope.	Slight-----------	Slight-----------	Good.
62D3--------------- Storden	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
62E3--------------- Storden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
73C---------------- Salida	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
73E---------------- Salida	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
83----------------- Kenyon	Moderate: percs slowly.	Moderate: seepage.	Slight-----------	Slight-----------	Good.
83B---------------- Kenyon	Moderate: percs slowly.	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.
83C2--------------- Kenyon	Moderate: percs slowly.	Severe: slope.	Slight-----------	Slight-----------	Good.
84----------------- Clyde	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
95----------------- Harps	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
107----------------- Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
135----------------- Coland	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness.	Poor: wetness, hard to pack.
138----------------- Clarion	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
138B---------------- Clarion	Slight-----------	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.
138C, 138C2--------- Clarion	Slight-----------	Severe: slope.	Slight-----------	Slight-----------	Good.
138D2--------------- Clarion	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
151, 152------------ Marshan	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
153----------------- Shandep	Severe: floods, wetness.	Severe: wetness, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods.	Poor: wetness, hard to pack.
169B---------------- Clarion	Slight-----------	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.
171----------------- Bassett	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
171B---------------- Bassett	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
171C2--------------- Bassett	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
171D2--------------- Bassett	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
171F---------------- Bassett	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
173----------------- Hoopeston	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
174, 174B----------- Bolan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
175, 175B----------- Dickinson	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
177, 177B----------- Saude	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.
177C, 177C2--------- Saude	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.
178, 178B----------- Waukee	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
184----------------- Klinger	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
188----------------- Kensett	Severe: depth to rock, wetness.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
198B---------------- Floyd	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
201B*:					
Coland-------------	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness.	Poor: wetness, hard to pack.
Terril-------------	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
213, 213B, 214, 214B--------------- Rockton	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
214C---------------- Rockton	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
216B, 217, 217B----- Ripon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
221, 221B----------- Palms	Severe: floods, subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, floods, excess humus.	Severe: ponding, floods, seepage.	Poor: ponding, excess humus.
225, 226------------ Lawler	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
236B---------------- Lester	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
236C, 236C2--------- Lester	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
236D2--------------- Lester	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
236E2, 236F: Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
274: Rolfe	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
284, 284B: Flagler	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
284C: Flagler	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
325: Le Sueur	Severe: wetness.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
329*:					
Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Nicollet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
335: Harcot	Severe: wetness, poor filter.	Severe: seepage, floods, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
354*:					
Aquolls.					
Histosols.					
377: Dinsdale	Slight	Moderate: seepage.	Slight	Slight	Good.
377B: Dinsdale	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
382: Maxfield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
391B*:					
Clyde	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Floyd	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
398: Tripoli	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
399: Readlyn	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
407B: Schley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
412C: Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
412E----------------- Sogn	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
444----------------- Jacwin	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, wetness.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
457----------------- Du Page	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage, wetness.	Severe: floods.	Good.
471----------------- Oran	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
507----------------- Canisteo	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
536----------------- Hanlon	Severe: floods, wetness.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Fair: wetness.
551----------------- Calamine	Severe: depth to rock, ponding, percs slowly.	Severe: depth to rock, ponding.	Severe: depth to rock, ponding, too clayey.	Severe: depth to rock, ponding.	Poor: area reclaim, too clayey, hard to pack.
558, 559------------ Talcot	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
583----------------- Minnetonka	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
611----------------- Rossfield Variant	Severe: depth to rock, wetness, percs slowly.	Severe: seepage, depth to rock, wetness.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, large stones.
612B---------------- Mottland	Moderate: large stones.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: large stones.
612C2--------------- Mottland	Moderate: large stones.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: large stones.
612E2--------------- Mottland	Moderate: slope, large stones.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: large stones.
612G2--------------- Mottland	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: seepage, slope.	Poor: slope, large stones.
613, 613B----------- Rossfield	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: large stones.
613C---------------- Rossfield	Slight-----------	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: large stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
614B----------------- Jacwin Variant	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: too clayey, hard to pack, area reclaim.
614C3---------------- Jacwin Variant	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: too clayey, hard to pack, area reclaim.
621------------------ Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
638C2*:					
Clarion------------	Slight-----------	Severe: slope.	Slight-----------	Slight-----------	Good.
Storden------------	Slight-----------	Severe: slope.	Slight-----------	Slight-----------	Good.
638D2*:					
Clarion------------	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Storden------------	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
651------------------ Faxon	Severe: floods, depth to rock, wetness.	Severe: depth to rock, floods, wetness.	Severe: floods, depth to rock, wetness.	Severe: floods, depth to rock, wetness.	Poor: area reclaim, wetness.
695------------------ Tilfer	Severe: floods, depth to rock, wetness.	Severe: depth to rock, floods, wetness.	Severe: floods, depth to rock, wetness.	Severe: floods, depth to rock, wetness.	Poor: area reclaim, wetness.
706------------------ Cerlin	Severe: percs slowly, wetness.	Slight-----------	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
706B----------------- Cerlin	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
725------------------ Hayfield	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
733------------------ Calco	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
755------------------ Nicollet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
777, 777B------------ Wapsie	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
777C2---------------- Wapsie	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
782------------------ Donnan	Severe: percs slowly, wetness.	Slight-----------	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
782B: Donnan	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
782C2: Donnan	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
836B: Kilkenny	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
836C2: Kilkenny	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
855: Shorewood	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Slight	Poor: too clayey.
936*:					
Coland	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness.	Poor: wetness, hard to pack.
Hanlon	Severe: floods, wetness.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Fair: wetness.
956*:					
Okoboji	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: hard to pack, ponding.
Harps	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
976: Raddle	Slight	Moderate: seepage.	Slight	Slight	Good.
1936*:					
Coland	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness.	Poor: wetness, hard to pack.
Hanlon	Severe: floods, wetness.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Fair: wetness.
5010*, 5030*. Pits					
5040*. Orthents					
5060*. Pits					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
6 Okoboji	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
27B Terril	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
29*:				
Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Nicollet	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
41B, 41C Sparta	Good	Probable	Improbable: too sandy.	Fair: too sandy.
55 Nicollet	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
62C3 Storden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
62D3 Storden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
62E3 Storden	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
73C, 73E Salida	Good	Probable	Probable	Poor: small stones, area reclaim, too sandy.
83, 83B, 83C2 Kenyon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
84 Clyde	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
95 Harps	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: large stones.
107 Webster	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
135 Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
138, 138B, 138C, 138C2 Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
138D2 Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
151, 152: Marshan	Fair: wetness.	Probable	Probable	Fair: area reclaim, thin layer.
153: Shandep	Poor: wetness.	Probable	Probable	Poor: wetness.
169B: Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
171, 171B, 171C2: Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
171D2: Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
171F: Bassett	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
173: Hoopeston	Fair: wetness.	Probable	Improbable: too sandy.	Fair: small stones, thin layer.
174, 174B: Bolan	Good	Probable	Improbable: too sandy.	Good.
175, 175B: Dickinson	Good	Probable	Improbable: too sandy.	Good.
177, 177B, 177C, 177C2: Saude	Good	Probable	Probable	Good.
178, 178B: Waukee	Good	Probable	Improbable: too sandy.	Good.
184: Klinger	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
188: Kensett	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
198B: Floyd	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
201B*:				
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Terril	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
213, 213B, 214, 214B, 214C: Rockton	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
216B, 217, 217B: Ripon	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
221, 221B------------- Palms	Poor: wetness.	Improbable: excess humus, excess fines.	Improbable: excess humus, excess fines.	Poor: wetness, excess humus.
225, 226-------------- Lawler	Fair: wetness.	Probable-------------	Probable-------------	Poor: area reclaim.
236B, 236C, 236C2----- Lester	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
236D2----------------- Lester	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
236E2, 236F----------- Lester	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
274------------------- Rolfe	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
284, 284B, 284C------- Flagler	Good-----------------	Probable-------------	Probable-------------	Fair: small stones, area reclaim, thin layer.
325------------------- Le Sueur	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
329*:				
Webster--------------	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
Nicollet-------------	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
335------------------- Harcot	Fair: wetness.	Probable-------------	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
354*:				
Aquolls.				
Histosols.				
377, 377B------------- Dinsdale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
382------------------- Maxfield	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
391B*:				
Clyde----------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Floyd----------------	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
398------------------- Tripoli	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
399: Readlyn	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
407B: Schley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
412C, 412E: Sogn	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
444: Jacwin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
457: Du Page	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
471: Oran	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
507: Canisteo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
536: Hanlon	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
551: Calamine	Poor: area reclaim, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
558, 559: Talcot	Fair: wetness.	Probable	Probable	Fair: small stones, area reclaim, thin layer.
583: Minnetonka	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
611: Rossfield Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
612B, 612C2, 612E2: Mottland	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.
612G2: Mottland	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, area reclaim, large stones.
613, 613B, 613C: Rossfield	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
614B, 614C3: Jacwin Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
621: Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
638C2*:				
Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Storden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
638D2*:				
Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Storden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
651 Faxon	Poor: area reclaim, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
695 Tilfer	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
706, 706B Cerlin	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
725 Hayfield	Fair: wetness.	Probable	Improbable: too sandy.	Poor: area reclaim.
733 Calco	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
755 Nicollet	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
777, 777B, 777C2 Wapsie	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
782, 782B, 782C2 Donnan	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
836B, 836C2 Kilkenny	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
855 Shorewood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
936*:				
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hanlon	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
956*:				
Okoboji	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Harps	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: large stones.
976 Raddle	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1936*:				
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1936*:				
Hanlon	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
5010*, 5030*. Pits				
5040*. Orthents				
5060*. Pits				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
6----------------- Okoboji	Moderate: seepage.	Severe: ponding.	Ponding, frost action.	Ponding, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily.
27B--------------- Terril	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Favorable------	Favorable.
29*:						
Clarion----------	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Nicollet---------	Moderate: seepage.	Severe: piping.	Frost action---	Wetness--------	Wetness--------	Favorable.
41B, 41C---------- Sparta	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
55---------------- Nicollet	Moderate: seepage.	Severe: piping.	Frost action---	Wetness--------	Wetness--------	Favorable.
62C3-------------- Storden	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
62D3, 62E3-------- Storden	Severe: slope.	Moderate: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
73C--------------- Salida	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, fast intake, slope.	Too sandy------	Droughty.
73E--------------- Salida	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, fast intake, slope.	Slope, too sandy.	Slope, droughty.
83---------------- Kenyon	Moderate: seepage.	Slight---------	Deep to water	Favorable------	Favorable------	Favorable.
83B, 83C2--------- Kenyon	Moderate: slope, seepage.	Slight---------	Deep to water	Slope----------	Favorable------	Favorable.
84---------------- Clyde	Moderate: seepage.	Severe: wetness.	Frost action, floods.	Wetness, floods.	Wetness--------	Wetness, erodes easily.
95---------------- Harps	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness--------	Wetness--------	Wetness.
107--------------- Webster	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness--------	Wetness--------	Wetness.
135--------------- Coland	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Wetness, floods.	Wetness--------	Wetness.
138--------------- Clarion	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
138B, 138C, 138C2- Clarion	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
138D2------------- Clarion	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
151, 152 Marshan	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness.
153 Shandep	Moderate: seepage.	Severe: wetness.	Frost action, floods.	Wetness, floods.	Wetness	Wetness.
169B Clarion	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
171 Bassett	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
171B, 171C2 Bassett	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
171D2, 171F Bassett	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope	Slope.
173 Hoopeston	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Wetness.
174 Bolan	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable	Too sandy	Favorable.
174B Bolan	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope	Too sandy	Favorable.
175 Dickinson	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing	Soil blowing, too sandy.	Favorable.
175B Dickinson	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing, slope.	Soil blowing, too sandy.	Favorable.
177 Saude	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
177B, 177C, 177C2 Saude	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
178 Waukee	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
178B Waukee	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
184 Klinger	Moderate: seepage.	Moderate: wetness, piping.	Slope, frost action.	Wetness, slope.	Wetness, erodes easily.	Erodes easily.
188 Kensett	Severe: seepage.	Severe: thin layer.	Depth to rock, frost action.	Wetness, depth to rock, rooting depth.	Depth to rock, wetness.	Depth to rock, rooting depth.
198B Floyd	Severe: seepage.	Moderate: piping, wetness.	Frost action	Wetness	Wetness	Favorable.
201B*:						
Coland	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Wetness, floods.	Wetness	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
201B*:						
Terril	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
213 Rockton	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
213B Rockton	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
214 Rockton	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
214B, 214C Rockton	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
216B Ripon	Moderate: slope, depth to rock, seepage.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Depth to rock	Depth to rock.
217 Ripon	Moderate: depth to rock, seepage.	Severe: thin layer.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
217B Ripon	Moderate: slope, depth to rock, seepage.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Depth to rock	Depth to rock.
221, 221B Palms	Severe: seepage.	Severe: excess humus, ponding.	Floods, ponding, subsides.	Ponding, soil blowing, floods.	Ponding, soil blowing.	Wetness.
225, 226 Lawler	Severe: seepage.	Severe: seepage.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Favorable.
236B, 236C, 236C2 Lester	Moderate: seepage, slope.	Severe: thin layer.	Deep to water	Slope	Erodes easily	Erodes easily.
236D2, 236E2, 236F Lester	Severe: slope.	Severe: thin layer.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
274 Rolfe	Moderate: seepage.	Severe: ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Ponding	Wetness, percs slowly.
284 Flagler	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
284B, 284C Flagler	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
325 Le Sueur	Moderate: seepage.	Moderate: wetness.	Frost action	Wetness	Wetness	Favorable.
329*:						
Webster	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Wetness	Wetness.
Nicollet	Moderate: seepage.	Severe: piping.	Frost action	Wetness	Wetness	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
335 Harcot	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, rooting depth.	Wetness, too sandy.	Wetness, rooting depth.
354*: Aquolls.						
Histosols.						
377 Dinsdale	Moderate: seepage.	Slight	Deep to water	Favorable	Erodes easily	Erodes easily.
377B Dinsdale	Moderate: slope, seepage.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
382 Maxfield	Moderate: seepage.	Severe: wetness.	Frost action	Wetness, rooting depth.	Wetness	Wetness, rooting depth.
391B*: Clyde	Moderate: seepage.	Severe: wetness.	Frost action, floods.	Wetness, floods.	Wetness	Wetness, erodes easily.
Floyd	Severe: seepage.	Moderate: piping, wetness.	Frost action	Wetness	Wetness	Favorable.
398 Tripoli	Moderate: seepage.	Severe: wetness.	Frost action	Wetness, rooting depth.	Wetness	Wetness, rooting depth.
399 Readlyn	Moderate: seepage.	Moderate: wetness.	Frost action	Wetness	Wetness	Favorable.
407B Schley	Moderate: seepage.	Moderate: wetness.	Frost action	Wetness	Wetness	Favorable.
412C Sogn	Severe: depth to rock.	Slight	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
412E Sogn	Severe: depth to rock, slope.	Slight	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
444 Jacwin	Moderate: seepage, depth to rock.	Severe: thin layer.	Percs slowly, depth to rock, frost action.	Wetness, percs slowly, depth to rock.	Depth to rock, wetness.	Depth to rock, rooting depth.
457 Du Page	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Floods	Favorable	Favorable.
471 Oran	Moderate: seepage.	Moderate: piping, wetness.	Frost action	Wetness	Wetness	Favorable.
507 Canisteo	Severe: seepage.	Severe: wetness.	Frost action	Wetness	Wetness	Wetness.
536 Hanlon	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, floods.	Soil blowing	Favorable.
551 Calamine	Moderate: depth to rock.	Severe: thin layer, ponding.	Ponding, percs slowly, depth to rock.	Ponding, percs slowly, depth to rock.	Depth to rock, erodes easily.	Wetness, erodes easily.
558, 559 Talcot	Severe: seepage.	Severe: seepage, wetness.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
583: Minnetonka	Moderate: seepage.	Severe: piping, hard to pack, wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness	Wetness, percs slowly.
611: Rossfield Variant	Severe: seepage.	Severe: piping.	Percs slowly, depth to rock, large stones.	Wetness, percs slowly, depth to rock.	Large stones, depth to rock, wetness.	Depth to rock, percs slowly.
612B, 612C2: Mottland	Severe: seepage.	Moderate: seepage, piping, large stones.	Deep to water	Rooting depth, slope, large stones.	Large stones	Rooting depth, large stones.
612E2, 612G2: Mottland	Severe: seepage, slope.	Moderate: seepage, piping, large stones.	Deep to water	Rooting depth, slope, large stones.	Slope, large stones.	Slope, rooting depth, large stones.
613: Rossfield	Severe: seepage.	Moderate: piping.	Deep to water	Rooting depth	Favorable	Rooting depth.
613B, 613C: Rossfield	Severe: seepage.	Moderate: piping.	Deep to water	Slope, rooting depth.	Favorable	Rooting depth.
614B, 614C3: Jacwin Variant	Moderate: seepage, slope, depth to rock.	Severe: thin layer.	Deep to rock, percs slowly, frost action.	Percs slowly, depth to rock, slope.	Erodes easily, percs slowly, depth to rock.	Depth to rock, rooting depth.
621: Houghton	Severe: seepage.	Severe: excess humus, ponding.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowing.	Wetness.
638C2*:						
Clarion	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Storden	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
638D2*:						
Clarion	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Storden	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
651: Faxon	Moderate: seepage, depth to rock.	Severe: piping, wetness.	Depth to rock, floods, frost action.	Wetness, depth to rock, floods.	Depth to rock, wetness.	Wetness, depth to rock.
695: Tilfer	Moderate: seepage, depth to rock.	Severe: thin layer, wetness.	Depth to rock, floods, frost action.	Wetness, depth to rock, floods.	Depth to rock, wetness.	Wetness, depth to rock.
706: Cerlin	Slight	Severe: hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily.	Percs slowly, erodes easily.
706B: Cerlin	Moderate: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Percs slowly, slope, wetness.	Wetness, erodes easily.	Percs slowly, erodes easily.
725: Hayfield	Severe: seepage.	Severe: seepage, piping.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Favorable.
733: Calco	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Floods, wetness.	Wetness	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
755----------------- Nicollet	Moderate: seepage.	Severe: piping.	Frost action---	Wetness--------	Wetness--------	Favorable.
777----------------- Wapsie	Severe: seepage.	Severe: seepage.	Deep to water	Rooting depth	Too sandy------	Rooting depth.
777B, 777C2-------- Wapsie	Severe: seepage.	Severe: seepage.	Deep to water	Rooting depth, slope.	Too sandy------	Rooting depth.
782----------------- Donnan	Slight---------	Severe: hard to pack.	Percs slowly, frost action.	Percs slowly, wetness.	Wetness, percs slowly.	Percs slowly.
782B, 782C2-------- Donnan	Moderate: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Wetness, percs slowly.	Percs slowly.
836B, 836C2-------- Kilkenny	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope----------	Favorable------	Favorable.
855----------------- Shorewood	Moderate: seepage.	Moderate: piping.	Deep to water	Percs slowly---	Erodes easily	Erodes easily, percs slowly.
936*:						
Coland-----------	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Wetness, floods.	Wetness--------	Wetness.
Hanlon-----------	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, floods.	Soil blowing---	Favorable.
956*:						
Okoboji----------	Moderate: seepage.	Severe: ponding.	Ponding, frost action.	Ponding, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily.
Harps------------	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness--------	Wetness--------	Wetness.
976----------------- Raddle	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
1936*:						
Coland-----------	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Wetness, floods.	Wetness--------	Wetness.
Hanlon-----------	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, floods.	Soil blowing---	Favorable.
5010*, 5030*. Pits						
5040*. Orthents						
5060*. Pits						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
6----------------- Okoboji	0-29	Silty clay loam	CH	A-7	0	100	100	90-100	80-95	55-65	30-40
	29-60	Silty clay loam	CH	A-7	0	100	100	90-100	80-95	55-65	30-40
27B--------------- Terril	0-30	Loam, clay loam	CL	A-6	0-5	100	95-100	70-90	60-80	30-40	10-20
	30-74	Clay loam, loam, sandy clay loam.	CL	A-6	0-5	100	100	85-95	65-85	25-40	10-20
29*:											
Clarion----------	0-13	Loam--------------	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	13-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-90	50-75	25-40	5-15
	36-63	Loam, sandy loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Nicollet---------	0-23	Loam--------------	OL, ML, CL	A-6, A-7	0	95-100	95-100	85-98	55-85	35-50	10-25
	23-29	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	55-80	35-50	15-25
	29-60	Loam--------------	CL, ML	A-6, A-4	0-5	95-100	90-100	75-90	50-75	30-40	5-15
41B, 41C---------- Sparta	0-25	Loamy fine sand	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
	25-60	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	85-100	85-100	50-95	5-50	---	NP
55---------------- Nicollet	0-23	Loam--------------	OL, ML, CL	A-6, A-7	0	95-100	95-100	85-98	55-85	35-50	10-25
	23-29	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	55-80	35-50	15-25
	29-60	Loam--------------	CL, ML	A-6, A-4	0-5	95-100	90-100	75-90	50-75	30-40	5-15
62C3, 62D3, 62E3- Storden	0-8	Loam--------------	ML, CL	A-4, A-6	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	8-60	Loam--------------	CL-ML, CL	A-4, A-6	0-5	95-100	85-97	70-85	55-70	20-40	5-15
73C, 73E---------- Salida	0-8	Sandy loam--------	SM, SP-SM	A-2, A-1	0-5	85-95	60-75	30-60	12-20	---	NP
	8-16	Gravelly loamy sand, gravelly coarse sand, gravelly loamy coarse sand.	SP, SW, GP, GP-GM	A-1	0-5	50-90	40-60	10-30	0-5	---	NP
	16-60	Very gravelly coarse sand, very gravelly sand.	SP, SW, GP, GP-GM	A-1	0-5	20-70	10-60	5-30	0-5	---	NP
83, 83B, 83C2----- Kenyon	0-22	Loam--------------	CL	A-6	0	100	95-100	85-95	65-75	30-40	10-20
	22-47	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-95	80-90	50-65	30-40	10-20
	47-60	Loam--------------	CL	A-6	0-5	90-95	85-95	80-90	50-65	25-35	10-20
84---------------- Clyde	0-20	Silty clay loam	OL, MH, ML, OH	A-7	0	100	100	80-90	55-75	45-60	15-25
	20-26	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	90-95	75-90	50-75	30-50	10-20
	26-33	Sandy loam--------	SM, SM-SC	A-2	2-5	80-95	75-90	50-80	15-35	15-20	NP-5
	33-72	Loam--------------	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	25-35	10-20
95---------------- Harps	0-16	Loam--------------	CL, CH	A-6, A-7	0-5	100	95-100	80-90	65-80	30-55	15-35
	16-46	Loam, clay loam, sandy clay loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	80-90	65-80	30-60	15-35
	46-65	Loam--------------	CL	A-6	0-5	95-100	90-100	70-80	50-75	25-40	10-25
107--------------- Webster	0-23	Silty clay loam	CL, CH	A-7, A-6	0-5	100	95-100	85-95	70-90	35-60	15-30
	23-37	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-5	95-100	95-100	85-95	60-80	35-50	15-30
	37-60	Loam, sandy loam, clay loam.	CL	A-6	0-5	95-100	90-100	75-85	50-75	30-40	10-20
135--------------- Coland	0-42	Clay loam---------	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	42-52	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
	52-60	Loamy sand--------	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
138, 138B, 138C, 138C2, 138D2----Clarion	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	13-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-90	50-75	25-40	5-15
	36-63	Loam, sandy loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	90-100	85-100	75-90	45-70	25-40	5-15
151-------------Marshan	0-18	Clay loam--------	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	35-50	15-25
	18-28	Loam, sandy loam	CL, CL-ML, SC, SM-SC	A-6, A-4	0	95-100	75-100	70-90	45-75	25-40	5-15
	28-60	Coarse sand, gravelly coarse sand, sand.	SP, SW, SP-SM	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
152-------------Marshan	0-20	Clay loam--------	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	35-50	15-25
	20-35	Loam, sandy loam	CL, CL-ML, SC, SM-SC	A-6, A-4	0	95-100	75-100	70-90	45-75	25-40	5-15
	35-60	Coarse sand, gravelly coarse sand, sand.	SP, SW, SP-SM	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
153-------------Shandep	0-29	Clay loam--------	CL, CH	A-7	0	95-100	95-100	90-100	85-95	40-55	20-30
	29-37	Silty clay loam, clay loam, loam.	CL	A-7	0	95-100	95-100	90-100	85-95	40-50	20-30
	37-45	Sandy loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4	0	95-100	80-90	75-80	30-50	20-30	3-10
	45-60	Loamy sand, gravelly loamy coarse sand, gravelly coarse sand.	SW, SP, SP-SM	A-1	0-5	65-90	60-80	20-45	2-5	---	NP
169B------------Clarion	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	13-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-90	50-75	25-40	5-15
	36-63	Loam, sandy loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	90-100	85-100	75-90	45-70	25-40	5-15
171, 171B, 171C2, 171D2, 171F-----Bassett	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	65-85	20-30	5-15
	8-40	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
	40-70	Loam-------------	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
173-------------Hoopeston	0-35	Fine sandy loam	SM	A-2, A-4	0	90-100	90-100	70-90	25-45	20-35	NP-10
	35-60	Loamy sand, sand	SP-SM, SM, SC, SM-SC	A-2, A-3	0	90-100	90-100	50-80	5-20	<25	NP-10
174, 174B--------Bolan	0-16	Loam-------------	CL, ML	A-4, A-6	0	100	100	85-95	50-70	30-40	5-15
	16-24	Loam-------------	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	100	80-90	40-55	25-35	5-15
	24-39	Fine sandy loam	SM, SM-SC, SC	A-4	0	100	100	80-90	35-50	15-25	2-8
	39-60	Loamy fine sand, fine sand.	SM, SP-SM	A-2	0	100	100	70-85	10-30	---	NP
175, 175B--------Dickinson	0-13	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	13-31	Fine sandy loam, sandy loam.	SM, SC, SM-SC	A-4	0	100	100	85-95	35-50	15-30	NP-10
	31-39	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	80-95	5-20	10-20	NP-5
	39-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
177, 177B, 177C, 177C2 Saude	0-15	Loam	CL	A-6	0	100	90-100	70-90	50-75	25-35	10-15
	15-25	Loam, sandy loam	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-95	80-95	70-85	36-60	20-30	5-15
	25-72	Loamy sand, gravelly coarse sand, sand.	SW, SM, GP, GM	A-1	2-10	50-90	50-85	20-40	3-25	---	NP
178, 178B Waukee	0-18	Loam	CL	A-6	0	100	90-100	70-90	50-75	30-40	10-20
	18-34	Loam, sandy clay loam.	CL, SM-SC, SC, CL-ML	A-6, A-4	0-5	85-95	80-95	65-85	40-60	20-35	5-15
	34-72	Gravelly sand, loamy coarse sand, sand.	SW, SM, SP-SM, SP	A-1	2-10	60-90	60-85	20-40	3-25	---	NP
184 Klinger	0-15	Silty clay loam	CL, ML	A-7	0	100	100	100	95-100	40-50	15-25
	15-30	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	30-76	Loam, clay loam	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
188 Kensett	0-15	Loam	OL, CL, ML	A-6, A-7	0	100	95-100	90-95	70-85	35-50	11-20
	15-26	Clay loam, loam	CL	A-6	2-5	90-95	85-95	80-90	55-70	30-40	15-25
	26-28	Sandy loam, loam, clay loam.	SM-SC, SC	A-4, A-2	2-5	90-95	80-90	50-60	20-40	15-25	5-10
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
198B Floyd	0-21	Loam, clay loam	CL, ML, OH	A-7, A-6	0	100	100	80-90	55-75	35-50	15-25
	21-32	Sandy clay loam, clay loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	32-78	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
201B*: Coland	0-42	Clay loam	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	42-52	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
	52-60	Loamy sand	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
Terril	0-30	Loam, clay loam	CL	A-6	0-5	100	95-100	70-90	60-80	30-40	10-20
	30-74	Clay loam, loam, sandy clay loam.	CL	A-6	0-5	100	100	85-95	65-85	25-40	10-20
213, 213B Rockton	0-13	Loam	ML, CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	13-29	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	10-20
	29-34	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	40-60	20-35
	34	Weathered bedrock	---	---	---	---	---	---	---	---	---
214, 214B, 214C Rockton	0-12	Loam	ML, CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	12-22	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	10-20
	22-24	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	40-60	20-35
	24	Weathered bedrock	---	---	---	---	---	---	---	---	---
216B Ripon	0-14	Silt loam	ML, CL-ML, CL	A-4	0	100	100	90-100	70-90	20-30	3-10
	14-20	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	70-95	25-40	10-20
	20-24	Clay loam, sandy clay loam, loam.	SC, CL	A-6	0-5	90-100	90-100	75-95	35-75	25-40	10-20
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
217, 217B--------- Ripon	0-14	Silt loam---------	ML, CL-ML, CL	A-4	0	100	100	90-100	70-90	20-30	3-10
	14-26	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	70-95	25-40	10-20
	26-36	Clay loam, sandy clay loam, loam.	SC, CL	A-6	0-5	90-100	90-100	75-95	35-75	25-40	10-20
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
221, 221B--------- Palms	0-36	Sapric material	Pt	---	---	---	---	---	---	---	---
	36-60	Clay loam, silty clay loam, loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
225-------------- Lawler	0-16	Loam-------------	CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	16-24	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	24-66	Stratified sandy loam to gravelly coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
226-------------- Lawler	0-20	Loam-------------	CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	20-36	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	36-60	Stratified sandy loam to gravelly coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
236B, 236C, 236C2, 236D2, 236E2, 236F----- Lester	0-8	Loam-------------	ML, CL	A-6, A-4	0	95-100	90-100	80-95	50-70	30-40	5-15
	8-38	Clay loam, loam	CL	A-7, A-6	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	38-60	Loam, clay loam	CL, CL-ML	A-6, A-4	0-5	95-100	90-100	75-90	50-70	20-40	5-20
274-------------- Rolfe	0-21	Silt loam---------	OL, CL, ML	A-6, A-4	0	100	95-100	90-100	80-95	30-40	5-15
	21-43	Clay, silty clay, clay loam.	CH	A-7	0	100	95-100	90-100	75-95	50-65	25-35
	43-60	Clay loam, loam	CL	A-7, A-6	0	95-100	90-100	80-90	55-75	30-45	10-20
284, 284B, 284C-- Flagler	0-15	Sandy loam--------	SC, SM-SC	A-2, A-4	0	95-100	90-95	60-70	25-40	15-25	5-10
	15-22	Sandy loam--------	SC, SM-SC	A-2, A-4	0	95-100	90-95	50-70	25-40	15-25	5-10
	22-84	Loamy sand, gravelly sand, coarse sand.	SP-SM, SW, SP, SW-SM	A-1	0-5	70-90	70-85	20-40	3-12	---	NP
325-------------- Le Sueur	0-11	Loam-------------	CL, ML, CL-ML	A-6, A-4	0	95-100	95-100	90-100	70-85	20-40	5-15
	11-35	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	35-50	15-25
	35-60	Loam-------------	CL-ML, CL	A-6, A-4	0-5	95-100	90-100	80-95	55-75	20-40	5-20
329*:											
Webster----------	0-23	Silty clay loam	CL, CH	A-7, A-6	0-5	100	95-100	85-95	70-90	35-60	15-30
	23-37	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-5	95-100	95-100	85-95	60-80	35-50	15-30
	37-60	Loam, sandy loam, clay loam.	CL	A-6	0-5	95-100	90-100	75-85	50-75	30-40	10-20
Nicollet---------	0-23	Loam-------------	OL, ML, CL	A-6, A-7	0	95-100	95-100	85-98	55-85	35-50	10-25
	23-29	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	55-80	35-50	15-25
	29-60	Loam-------------	CL, ML	A-6, A-4	0-5	95-100	90-100	75-90	50-75	30-40	5-15
335-------------- Harcot	0-22	Loam-------------	CH, CL, OH, OL	A-7	0	95-100	90-95	80-90	55-75	40-55	15-25
	22-33	Loam, clay loam, sandy clay loam.	CL	A-6	0	95-100	90-95	75-85	55-75	30-40	10-20
	33-60	Fine sand, loamy fine sand, gravelly sand.	SP, SM, SP-SM	A-1	0-5	80-95	75-95	40-50	3-25	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
354*:											
Aquolls.											
Histosols.											
377, 377B-------- Dinsdale	0-17	Silty clay loam	ML, CL	A-6, A-7	0	100	100	100	95-100	30-50	10-20
	17-27	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	27-68	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
382-------------- Maxfield	0-20	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	20-31	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	31-66	Loam-------------	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
391B*:											
Clyde-----------	0-20	Silty clay loam	OL, MH, ML, OH	A-7	0	100	100	80-90	55-75	45-60	15-25
	20-26	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	90-95	75-90	50-75	30-50	10-20
	26-33	Sandy loam-------	SM, SM-SC	A-2	2-5	80-95	75-90	50-80	15-35	15-20	NP-5
	33-72	Loam-------------	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	25-35	10-20
Floyd-----------	0-21	Loam, clay loam	CL, ML, OH	A-7, A-6	0	100	100	80-90	55-75	35-50	15-25
	21-32	Sandy clay loam, clay loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	32-78	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
398-------------- Tripoli	0-18	Silty clay loam	CL	A-6, A-7	0	100	100	85-95	55-75	35-45	15-25
	18-36	Clay loam, loam	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	11-20
	36-60	Loam, sandy clay loam, clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	30-40	11-20
399-------------- Readlyn	0-17	Loam-------------	CL	A-6	0	100	100	85-95	55-75	30-40	15-25
	17-39	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	30-40	10-20
	39-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	25-35	10-20
407B------------- Schley	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	80-90	55-75	25-40	5-15
	8-48	Loam, sandy loam, silty clay loam.	CL, SC, SM-SC, CL-ML	A-2, A-4	2-8	90-95	70-80	50-70	20-60	20-30	5-10
	48-76	Loam, sandy clay loam, sandy loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-40	10-20
412C, 412E------- Sogn	0-11	Loam-------------	CL	A-6	0-10	85-100	85-100	85-100	70-95	25-40	11-23
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
444-------------- Jacwin	0-22	Silty clay loam	OL, ML	A-7	0	100	100	90-95	50-65	40-50	10-20
	22-32	Loam, sandy clay loam, silt loam.	CL, SC	A-6	2-5	95-100	90-95	85-95	45-65	25-35	10-20
	32-48	Silty clay, clay	CL, CH	A-7	0	100	100	95-100	80-95	40-55	20-30
	48-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
457-------------- Du Page	0-60	Silt loam--------	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-45	11-21
471-------------- Oran	0-13	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-95	55-75	25-35	5-15
	13-41	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	10-20
	41-72	Loam-------------	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
507--------------- Canisteo	0-18	Silty clay loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	85-100	35-50	15-25
	18-42	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	98-100	90-100	85-95	65-85	38-50	25-35
	42-68	Silt loam, loam, sandy loam.	CL, ML, SM, SC	A-6, A-4	0-5	90-100	80-95	60-90	40-80	30-40	5-15
536--------------- Hanlon	0-48	Fine sandy loam	SM-SC, SC, SM	A-4	0	100	100	75-80	35-50	25-35	5-10
	48-72	Sandy loam, fine sandy loam, loamy fine sand.	SM-SC, SC	A-4, A-2	0	100	100	75-80	25-40	15-25	5-10
551--------------- Calamine	0-18	Silty clay loam	CL	A-6	0	100	100	95-100	90-100	25-40	10-20
	18-33	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	95-100	90-100	50-60	25-35
	33-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
558--------------- Talcot	0-18	Clay loam---------	CL	A-7	0	100	100	80-90	60-85	40-50	15-25
	18-27	Clay loam, silty clay loam, loam.	CL	A-7	0	95-100	85-100	70-90	60-85	40-50	15-25
	27-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, SW	A-1	0	65-90	50-85	20-50	2-10	---	NP
559--------------- Talcot	0-20	Clay loam---------	CL	A-7	0	100	100	80-90	60-85	40-50	15-25
	20-33	Clay loam, silty clay loam, loam.	CL	A-7	0	95-100	85-100	70-90	60-85	40-50	15-25
	33-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, SW	A-1	0	65-90	50-85	20-50	2-10	---	NP
583--------------- Minnetonka	0-17	Silty clay loam	MH, ML	A-5, A-7	0	95-100	95-100	90-98	85-95	40-55	6-20
	17-42	Silty clay, silty clay loam.	MH, CH, CL, ML	A-7	0	95-100	95-100	90-98	85-95	40-65	12-35
	42-60	Silty clay loam, silt loam, clay loam.	MH, ML, CL	A-7, A-4, A-6	0	95-100	85-100	75-100	60-95	30-55	5-25
611--------------- Rossfield Variant	0-19	Silty clay loam	CL	A-7	0-2	95-100	95-100	90-100	65-80	40-50	15-20
	19-30	Silty clay loam	CL	A-6, A-7	0-2	95-100	95-100	90-100	65-80	35-45	10-20
	30-38	Silty clay--------	CL, CH	A-7	2-10	90-100	90-100	90-95	65-75	45-60	25-35
	38-60	Channery silty clay loam.	CL, CL-ML, SC	A-4	15-35	70-80	65-75	50-60	35-60	<20	2-8
612B, 612C2, 612E2, 612G2----- Mottland	0-8	Loam--------------	CL, CL-ML	A-6, A-4	3-10	90-95	75-85	70-80	55-65	25-40	5-15
	8-60	Channery fine sandy loam, channery sandy loam, channery loam.	SM, SC, SM-SC	A-2	15-35	80-90	75-85	50-60	20-30	<20	2-8
613, 613B, 613C-- Rossfield	0-13	Silt loam, silty clay loam.	CL	A-6	0-1	95-100	95-100	90-100	70-80	30-40	10-20
	13-29	Silty clay loam, clay loam, loam.	CL	A-6	5-10	80-90	70-80	60-70	55-65	30-40	10-20
	29-60	Channery sandy loam, channery fine sandy loam, channery loam.	SM, SC, SM-SC	A-2, A-4	15-25	80-90	75-85	50-60	30-40	<20	2-8
614B------------- Jacwin Variant	0-16	Loam, clay loam	CL, CH	A-7	0	100	100	90-95	70-80	45-55	20-30
	16-28	Clay loam, loam	CL	A-7, A-6	0	100	100	85-90	65-80	35-50	25-35
	28-35	Silty clay--------	CL, CH	A-7	0	100	100	95-100	80-95	40-55	20-30
	35-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
614C3------------ Jacwin Variant	0-8	Silty clay loam	CL, CH	A-7	0	100	100	90-95	70-80	45-55	20-30
	8-24	Clay loam, silty clay.	CH	A-7	0	100	100	85-95	65-80	50-60	25-35
	24-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
621-------------- Houghton	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
638C2*, 638D2*:											
Clarion---------	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	13-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-90	50-75	25-40	5-15
	36-63	Loam, sandy loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Storden---------	0-8	Loam-------------	ML, CL	A-4, A-6	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	8-60	Loam-------------	CL-ML, CL	A-4, A-6	0-5	95-100	85-97	70-85	55-70	20-40	5-15
651-------------- Faxon	0-27	Silty clay loam	CL	A-7	0-10	95-100	85-100	85-100	80-95	40-50	15-25
	27-36	Loam, sandy loam, clay loam.	CL, ML, SC, SM	A-7, A-6	0-10	95-100	70-100	65-95	40-85	30-50	10-20
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
695-------------- Tilfer	0-17	Silty clay loam, clay loam.	MH, OL, ML, OH	A-7	0	95-100	95-100	80-90	70-85	45-55	15-25
	17-32	Loam, clay loam, silty clay loam.	SC, CL, ML	A-6, A-7	2-5	90-95	85-90	60-70	45-70	35-45	11-20
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
706, 706B-------- Cerlin	0-14	Silt loam--------	CL, ML	A-6, A-7	0	100	95-100	95-100	65-85	35-45	10-20
	14-31	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	95-100	90-100	60-75	35-50	15-25
	31-63	Clay, silty clay	CH	A-7	0	100	95-100	95-100	70-90	55-70	30-40
	63-90	Silty clay, clay loam, loam.	CL, CH	A-6, A-7	0-5	95-100	90-95	80-95	50-75	35-60	15-30
725-------------- Hayfield	0-13	Loam-------------	ML, CL	A-6, A-4	0	100	100	90-98	70-90	25-40	3-15
	13-27	Loam, sandy loam, clay loam.	ML, CL	A-4, A-6	0	98-100	95-100	70-90	65-80	25-40	3-15
	27-60	Coarse sand, gravelly coarse sand, sand.	SP, SP-SM	A-1	0-3	85-100	50-98	20-45	0-10	---	NP
733-------------- Calco	0-37	Silty clay loam	CH, CL	A-7	0	100	100	95-100	85-100	40-60	15-30
	37-53	Silty clay loam, loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	80-100	30-45	10-20
	53-60	Sandy loam, gravelly sand.	SP, SP-SM	A-1	0-3	85-100	50-95	20-45	0-10	---	NP
755-------------- Nicollet	0-23	Loam-------------	OL, ML, CL	A-6, A-7	0	95-100	95-100	85-98	55-85	35-50	10-25
	23-29	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	55-80	35-50	15-25
	29-60	Loam-------------	CL, ML	A-6, A-4	0-5	95-100	90-100	75-90	50-75	30-40	5-15
777, 777B, 777C2- Wapsie	0-8	Loam-------------	CL, ML, CL-ML	A-4	0	100	90-100	70-90	50-75	25-35	5-10
	8-28	Loam, sandy loam	CL, SC, CL-ML, SM-SC	A-4, A-6	0	85-95	80-95	70-85	40-60	20-35	5-15
	28-60	Gravelly loamy sand, gravelly sand.	SW, SM, SP, SP-SM	A-1	0	60-90	60-85	20-40	3-25	---	NP
782, 782B, 782C2- Donnan	0-7	Loam-------------	CL, ML	A-4, A-6	0	100	100	85-95	65-80	30-40	5-15
	7-32	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-95	80-90	60-75	35-50	15-30
	32-60	Clay, silty clay	CH	A-7	0-5	95-100	90-95	80-90	60-75	55-70	30-40
836B, 836C2------ Kilkenny	0-8	Clay loam--------	ML, MH	A-7	0	95-100	95-100	80-95	70-85	40-60	10-25
	8-34	Clay loam, silty clay loam.	CL	A-7, A-6	0	95-100	90-98	80-95	65-80	35-50	15-30
	34-71	Clay loam, silty clay.	CL, CH	A-7	0-5	95-100	90-98	75-90	60-75	40-70	18-40

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
855-------------- Shorewood	0-16	Silty clay loam	CL, ML	A-6, A-7	0	100	100	90-98	85-98	35-50	12-20
	16-44	Silty clay, silty clay loam.	MH	A-7	0	100	100	90-100	85-98	55-75	20-40
	44-66	Clay loam, silty clay loam, silty clay.	CL, ML	A-6, A-7	0-5	98-100	90-98	85-98	80-95	35-50	10-20
936*:											
Coland----------	0-42	Clay loam--------	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	42-52	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
	52-60	Loamy sand-------	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
Hanlon----------	0-48	Fine sandy loam	SM-SC, SC, SM	A-4	0	100	100	75-80	35-50	25-35	5-10
	48-72	Sandy loam, fine sandy loam, loamy fine sand.	SM-SC, SC	A-4, A-2	0	100	100	75-80	25-40	15-25	5-10
956*:											
Okoboji---------	0-29	Silty clay loam	CH	A-7	0	100	100	90-100	80-95	55-65	30-40
	29-60	Silty clay loam	CH	A-7	0	100	100	90-100	80-95	55-65	30-40
Harps-----------	0-16	Loam-------------	CL, CH	A-6, A-7	0-5	100	95-100	80-90	65-80	30-55	15-35
	16-46	Loam, clay loam, sandy clay loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	80-90	65-80	30-60	15-35
	46-65	Loam-------------	CL	A-6	0-5	95-100	90-100	70-80	50-75	25-40	10-25
976-------------- Raddle	0-15	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	85-100	25-35	8-15
	15-65	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	20-30	4-14
1936*:											
Coland----------	0-42	Clay loam--------	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	42-52	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
	52-60	Loamy sand-------	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
Hanlon----------	0-48	Fine sandy loam	SM-SC, SC, SM	A-4	0	100	100	75-80	35-50	25-35	5-10
	48-72	Sandy loam, fine sandy loam, loamy fine sand.	SM-SC, SC	A-4, A-2	0	100	100	75-80	25-40	15-25	5-10
5010*, 5030*. Pits											
5040*. Orthents											
5060*. Pits											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
6---------------- Okoboji	0-29	35-42	1.25-1.30	0.2-0.6	0.21-0.23	6.6-7.8	High---------	0.37	5	4	9-11
	29-60	35-42	1.30-1.35	0.2-0.6	0.18-0.20	6.6-7.8	High---------	0.37			
27B-------------- Terril	0-30	18-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.24	5	6	4-5
	30-74	22-30	1.45-1.70	0.6-2.0	0.16-0.18	6.1-7.8	Low-----------	0.32			
29*:											
Clarion---------	0-13	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	5	6	3-4
	13-36	24-30	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.8	Low-----------	0.37			
	36-63	12-22	1.70-1.80	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
Nicollet--------	0-23	24-35	1.15-1.25	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.24	5	6	4-8
	23-29	24-35	1.25-1.35	0.6-2.0	0.15-0.19	5.6-7.8	Moderate-----	0.32			
	29-60	22-28	1.35-1.45	0.6-2.0	0.14-0.19	7.4-7.8	Low-----------	0.32			
41B, 41C--------- Sparta	0-25	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low-----------	0.17	5	2	1-2
	25-60	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-7.3	Low-----------	0.17			
55--------------- Nicollet	0-23	24-35	1.15-1.25	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.24	5	6	4-8
	23-29	24-35	1.25-1.35	0.6-2.0	0.15-0.19	5.6-7.8	Moderate-----	0.32			
	29-60	22-28	1.35-1.45	0.6-2.0	0.14-0.19	7.4-7.8	Low-----------	0.32			
62C3, 62D3, 62E3- Storden	0-8	18-27	1.35-1.45	0.6-2.0	0.20-0.22	7.4-8.4	Low-----------	0.28	5	4L	.5-1
	8-60	18-27	1.35-1.65	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
73C, 73E--------- Salida	0-8	5-15	1.35-1.45	2.0-6.0	0.10-0.12	6.1-8.4	Low-----------	0.10	3	8	1-2
	8-16	2-8	1.50-1.65	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
	16-60	0-5	1.50-1.65	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
83, 83B, 83C2---- Kenyon	0-22	20-25	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	5	6	3-4
	22-47	20-30	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low-----------	0.28			
	47-60	20-24	1.65-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low-----------	0.37			
84--------------- Clyde	0-20	28-32	1.40-1.45	0.6-2.0	0.21-0.23	6.1-7.3	Moderate-----	0.28	5	7	7-11
	20-26	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.37			
	26-33	10-15	1.60-1.70	2.0-6.0	0.11-0.13	6.1-7:3	Low-----------	0.37			
	33-72	20-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Moderate-----	0.37			
95--------------- Harps	0-16	25-35	1.35-1.40	0.6-2.0	0.19-0.21	7.9-8.4	Moderate-----	0.24	5	4L	4-5
	16-46	18-32	1.40-1.50	0.6-2.0	0.17-0.19	7.9-8.4	Moderate-----	0.32			
	46-65	20-26	1.50-1.70	0.6-2.0	0.17-0.19	7.9-8.4	Moderate-----	0.32			
107-------------- Webster	0-23	26-36	1.35-1.40	0.6-2.0	0.19-0.21	6.6-7.3	Moderate-----	0.24	5	6	6-7
	23-37	25-35	1.40-1.50	0.6-2.0	0.16-0.18	6.6-7.8	Moderate-----	0.32			
	37-60	18-29	1.50-1.70	0.6-2.0	0.17-0.19	7.4-8.4	Moderate-----	0.32			
135-------------- Coland	0-42	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28	5	7	5-7
	42-52	12-26	1.50-1.65	2.0-6.0	0.13-0.17	6.1-7.3	Low-----------	0.28			
	52-60	2-8	1.65-1.75	6.0-20	0.08-0.10	6.1-7.3	Low-----------	0.17			
138, 138B, 138C, 138C2, 138D2---- Clarion	0-13	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	5	6	3-4
	13-36	24-30	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.8	Low-----------	0.37			
	36-63	12-22	1.70-1.80	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
151-------------- Marshan	0-18	27-35	1.30-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	4	7	4-8
	18-28	18-30	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low-----------	0.28			
	28-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.8	Low-----------	0.15			
152-------------- Marshan	0-20	27-35	1.30-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	4	7	4-8
	20-35	18-30	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low-----------	0.28			
	35-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.8	Low-----------	0.15			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
153----------------	0-29	26-32	1.35-1.40	0.6-2.0	0.20-0.23	6.1-7.8	Moderate-----	0.24	5	7	7-9
Shandep	29-37	26-32	1.40-1.60	0.6-2.0	0.17-0.20	6.1-7.8	Moderate-----	0.24			
	37-45	8-12	1.60-1.70	2.0-6.0	0.12-0.14	6.1-7.8	Low-----------	0.24			
	45-60	2-8	1.60-1.70	6.0-20	0.02-0.04	6.1-8.4	Low-----------	0.15			
169B--------------	0-13	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	5	6	3-4
Clarion	13-36	24-30	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.8	Low-----------	0.37			
	36-63	12-22	1.70-1.80	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
171, 171B, 171C2, 171D2, 171F------	0-8	18-25	1.45-1.50	0.6-2.0	0.19-0.21	5.1-7.3	Low-----------	0.28	5-4	6	2-3
Bassett	8-40	20-28	1.55-1.65	0.6-2.0	0.17-0.19	4.5-6.5	Low-----------	0.28			
	40-70	20-24	1.65-1.80	0.6-2.0	0.17-0.19	5.1-8.4	Low-----------	0.37			
173----------------	0-35	8-18	1.35-1.70	2.0-6.0	0.12-0.15	5.1-7.3	Low-----------	0.28	4	3	2-3
Hoopeston	35-60	2-10	1.50-1.80	6.0-20	0.05-0.10	5.6-7.8	Low-----------	0.28			
174, 174B---------	0-16	20-26	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6	3-4
Bolan	16-24	14-20	1.45-1.50	0.6-2.0	0.17-0.19	5.6-6.5	Low-----------	0.28			
	24-39	10-15	1.50-1.60	2.0-6.0	0.11-0.13	6.1-7.3	Low-----------	0.28			
	39-60	2-8	1.60-1.70	6.0-20	0.08-0.10	6.1-7.3	Low-----------	0.17			
175, 175B---------	0-13	12-18	1.50-1.55	2.0-6.0	0.12-0.15	5.6-7.3	Low-----------	0.20	4	3	1-2
Dickinson	13-31	10-15	1.45-1.55	2.0-6.0	0.12-0.15	5.1-6.5	Low-----------	0.20			
	31-39	5-10	1.55-1.65	6.0-20	0.08-0.10	5.1-6.5	Low-----------	0.20			
	39-60	5-10	1.60-1.70	6.0-20	0.02-0.04	5.6-6.5	Low-----------	0.15			
177, 177B, 177C, 177C2------------	0-15	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	5	2-4
Saude	15-25	12-20	1.40-1.50	0.6-6.0	0.15-0.19	5.1-6.0	Low-----------	0.28			
	25-72	2-8	1.50-1.75	>20	0.02-0.06	5.1-6.5	Very low-----	0.10			
178, 178B---------	0-18	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.24	4	6	3-4
Waukee	18-34	20-26	1.40-1.50	0.6-2.0	0.15-0.19	4.5-6.5	Low-----------	0.32			
	34-72	2-8	1.50-1.75	>20	0.02-0.06	5.6-7.3	Low-----------	0.10			
184----------------	0-15	26-30	1.30-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	5	6	5-6
Klinger	15-30	28-35	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	30-76	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.6-7.8	Low-----------	0.43			
188----------------	0-15	24-29	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate-----	0.28	3	6	5-6
Kensett	15-26	22-29	1.40-1.60	0.6-2.0	0.17-0.19	6.1-6.5	Moderate-----	0.28			
	26-28	14-29	1.60-1.75	2.0-6.0	0.11-0.13	6.1-6.5	Low-----------	0.28			
	28	---	---	---	---	---	--------------	----			
198B--------------	0-21	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24	5	6	5-7
Floyd	21-32	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low-----------	0.32			
	32-78	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-7.8	Low-----------	0.32			
201B*:											
Coland-----------	0-42	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High----------	0.28	5	7	5-7
	42-52	12-26	1.50-1.65	2.0-6.0	0.13-0.17	6.1-7.3	Low-----------	0.28			
	52-60	2-8	1.65-1.75	6.0-20	0.08-0.10	6.1-7.3	Low-----------	0.28			
Terril-----------	0-30	18-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.24	5	6	4-5
	30-74	22-30	1.45-1.70	0.6-2.0	0.16-0.18	6.1-7.8	Low-----------	0.32			
213, 213B---------	0-13	18-28	1.30-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.28	4	6	2-6
Rockton	13-29	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28			
	29-34	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High----------	0.28			
	34	---	---	---	---	---	--------------	----			
214, 214B, 214C---	0-12	18-28	1.30-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.28	4	6	2-6
Rockton	12-22	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28			
	22-24	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High----------	0.28			
	24	---	---	---	---	---	--------------	----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
216B: Ripon	0-14	10-18	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.8	Low	0.32	4	5	2-4
	14-20	22-30	1.55-1.65	0.6-2.0	0.18-0.22	5.1-6.5	Moderate	0.32			
	20-24	22-45	1.55-1.70	0.6-2.0	0.14-0.19	6.1-8.4	Moderate	0.32			
	24	---	---	---	---	---	---	---			
217, 217B: Ripon	0-14	10-18	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.8	Low	0.32	4	5	2-4
	14-26	22-30	1.55-1.65	0.6-2.0	0.18-0.22	5.1-6.5	Moderate	0.32			
	26-36	22-45	1.55-1.70	0.6-2.0	0.14-0.19	6.1-8.4	Moderate	0.32			
	36	---	---	---	---	---	---	---			
221, 221B: Palms	0-36	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8	---	---	---	3	>20
	36-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low	---			
225: Lawler	0-16	18-28	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.28	4	6	4-5
	16-24	20-28	1.45-1.60	0.6-2.0	0.16-0.18	5.1-6.5	Low	0.28			
	24-66	2-12	1.60-1.75	>20	0.02-0.04	5.1-6.5	Low	0.10			
226: Lawler	0-20	18-28	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.28	4	6	4-5
	20-36	20-28	1.45-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Low	0.28			
	36-60	2-12	1.60-1.75	>20	0.02-0.04	5.1-7.8	Low	0.10			
236B, 236C, 236C2, 236D2, 236E2, 236F: Lester	0-8	15-27	1.30-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.28	5	6	2-4
	8-38	20-35	1.45-1.55	0.6-2.0	0.15-0.19	5.1-6.5	Moderate	0.28			
	38-60	20-30	1.55-1.75	0.6-2.0	0.14-0.19	6.6-7.8	Low	0.37			
274: Rolfe	0-21	22-28	1.35-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Moderate	0.28	5	6	3-5
	21-43	38-45	1.40-1.50	0.06-0.2	0.11-0.13	6.1-7.3	High	0.28			
	43-60	24-35	1.50-1.60	0.2-2.0	0.14-0.16	6.1-8.4	Moderate	0.28			
284, 284B, 284C: Flagler	0-15	12-18	1.50-1.55	2.0-6.0	0.12-0.14	5.6-7.3	Low	0.20	4	3	1-2
	15-22	10-15	1.55-1.60	2.0-6.0	0.11-0.13	5.1-6.5	Low	0.20			
	22-84	2-8	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low	0.20			
325: Le Sueur	0-11	20-27	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.24	5	6	2-4
	11-35	24-35	1.30-1.45	0.6-2.0	0.15-0.19	5.1-6.5	Moderate	0.32			
	35-60	20-27	1.50-1.65	0.6-2.0	0.15-0.19	7.4-8.4	Moderate	0.32			
329*: Webster	0-23	26-36	1.35-1.40	0.6-2.0	0.19-0.21	6.6-7.3	Moderate	0.24	5	6	6-7
	23-37	25-35	1.40-1.50	0.6-2.0	0.16-0.18	6.6-7.8	Moderate	0.32			
	37-60	18-29	1.50-1.70	0.6-2.0	0.17-0.19	7.4-8.4	Moderate	0.32			
Nicollet	0-23	24-35	1.15-1.25	0.6-2.0	0.17-0.22	5.6-7.3	Moderate	0.24	5	6	4-8
	23-29	24-35	1.25-1.35	0.6-2.0	0.15-0.19	5.6-7.8	Moderate	0.32			
	29-60	22-28	1.35-1.45	0.6-2.0	0.14-0.19	7.4-7.8	Low	0.32			
335: Harcot	0-22	24-29	1.35-1.40	0.6-2.0	0.20-0.22	7.9-8.4	Moderate	0.28	4	6	5-6
	22-33	18-30	1.40-1.60	0.6-2.0	0.17-0.19	7.9-8.4	Moderate	0.28			
	33-60	2-8	1.60-1.75	>20	0.05-0.07	6.6-8.4	Low	0.15			
354*: Aquolls.											
Histosols.											
377, 377B: Dinsdale	0-17	25-29	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Moderate	0.32	5	7	3-5
	17-27	30-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate	0.43			
	27-68	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.6-8.4	Low	0.43			
382: Maxfield	0-20	30-35	1.35-1.40	0.6-2.0	0.21-0.23	6.6-7.3	High	0.24	5	6	6-7
	20-31	25-34	1.40-1.50	0.6-2.0	0.18-0.20	6.1-7.3	High	0.32			
	31-66	20-26	1.65-1.85	0.6-2.0	0.17-0.19	6.1-7.8	Low	0.32			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
391B*:											
Clyde	0-20	28-32	1.40-1.45	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	0.28	5	7	7-11
	20-26	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate	0.37			
	26-33	10-15	1.60-1.70	2.0-6.0	0.11-0.13	6.1-7.3	Low	0.37			
	33-72	20-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Moderate	0.37			
Floyd	0-21	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.24	5	6	5-7
	21-32	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low	0.32			
	32-78	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-7.8	Low	0.32			
398 Tripoli	0-18	28-32	1.40-1.45	0.6-2.0	0.19-0.21	6.6-7.3	Moderate	0.24	5	6	6-7
	18-36	22-28	1.45-1.70	0.6-2.0	0.17-0.19	7.4-7.8	Low	0.32			
	36-60	20-28	1.70-1.80	0.6-2.0	0.17-0.19	7.4-8.4	Low	0.32			
399 Readlyn	0-17	18-24	1.35-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.24	5	6	4-6
	17-39	22-28	1.45-1.70	0.6-2.0	0.17-0.19	5.1-6.5	Low	0.32			
	39-60	18-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low	0.32			
407B Schley	0-8	18-22	1.40-1.45	0.6-2.0	0.19-0.21	4.5-7.3	Moderate	0.32	5	6	2-3
	8-48	15-28	1.45-1.65	0.6-2.0	0.12-0.16	4.5-6.1	Low	0.32			
	48-76	20-28	1.65-1.80	0.6-2.0	0.16-0.18	5.1-7.8	Low	0.32			
412C, 412E Sogn	0-11	18-25	1.15-1.20	0.6-2.0	0.17-0.22	6.1-8.4	Moderate	0.32	1	4L	1-3
	11	---	---	---	---	---	-------------	----			
444 Jacwin	0-22	22-34	1.35-1.45	0.6-2.0	0.20-0.22	6.6-7.3	Moderate	0.28	5	6	6-8
	22-32	24-34	1.50-1.60	0.6-2.0	0.17-0.19	6.6-7.8	Low	0.28			
	32-48	40-60	1.70-1.80	<0.06	0.12-0.14	7.4-8.4	Moderate	0.28			
	48-60	---	1.80-1.90	---	---	---	-------------	----			
457 Du Page	0-60	18-27	1.40-1.60	0.6-2.0	0.22-0.24	6.6-8.4	Moderate	0.28	5	6	3-5
471 Oran	0-13	16-24	1.40-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Low	0.28	5	6	2-3
	13-41	22-28	1.45-1.70	0.6-2.0	0.17-0.19	5.1-6.5	Low	0.28			
	41-72	20-26	1.45-1.70	0.6-2.0	0.17-0.19	7.4-7.8	Low	0.37			
507 Canisteo	0-18	18-35	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	Moderate	0.32	5	4L	4-8
	18-42	20-35	1.35-1.50	0.6-2.0	0.15-0.19	7.4-8.4	Moderate	0.32			
	42-68	10-35	1.30-1.50	0.6-6.0	0.12-0.18	7.4-8.4	Low	0.32			
536 Hanlon	0-48	12-15	1.50-1.70	2.0-6.0	0.16-0.18	6.6-7.3	Low	0.20	5	3	2-3
	48-72	5-10	1.70-1.75	2.0-6.0	0.11-0.13	5.6-7.3	Low	0.20			
551 Calamine	0-18	27-35	1.30-1.40	0.6-2.0	0.18-0.23	6.1-7.8	Moderate	0.28	5	7	7-9
	18-33	35-50	1.55-1.65	<0.06	0.08-0.12	6.1-7.8	Moderate	0.28			
	33-60	---	1.80-1.90	---	---	---	-------------	----			
558 Talcot	0-18	27-35	1.20-1.30	0.6-2.0	0.18-0.22	7.4-8.4	Moderate	0.28	4	7	4-8
	18-27	25-35	1.25-1.35	0.6-2.0	0.17-0.20	7.4-8.4	Moderate	0.28			
	27-60	1-6	1.55-1.65	6.0-20	0.02-0.04	7.4-8.4	Low	0.15			
559 Talcot	0-20	27-35	1.20-1.30	0.6-2.0	0.18-0.22	7.4-8.4	Moderate	0.28	4	7	4-8
	20-33	25-35	1.25-1.35	0.6-2.0	0.17-0.20	7.4-8.4	Moderate	0.28			
	33-60	1-6	1.55-1.65	6.0-20	0.02-0.04	7.4-8.4	Low	0.15			
583 Minnetonka	0-17	27-35	1.20-1.40	0.2-0.6	0.18-0.22	5.6-7.3	Moderate	0.28	5	7	4-8
	17-42	35-60	1.20-1.35	0.06-0.2	0.13-0.19	5.6-7.3	High	0.28			
	42-60	25-40	1.25-1.55	0.2-2.0	0.16-0.21	6.6-7.8	Moderate	0.28			
611 Rossfield Variant	0-19	28-32	1.30-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	0.32	4	7	5-7
	19-30	28-34	1.25-1.35	0.6-2.0	0.18-0.20	6.6-7.8	Moderate	0.32			
	30-38	42-48	1.50-1.60	0.06-0.2	0.12-0.14	6.6-7.8	Moderate	0.32			
	38-60	10-30	1.60-1.70	2.0-6.0	0.10-0.12	7.4-8.4	Low	----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
612B, 612C2, 612E2, 612G2----Mottland	0-8	16-22	1.45-1.55	0.6-2.0	0.16-0.18	6.6-8.4	Low----------	0.28	2	6	2-3
	8-60	10-15	1.60-1.90	2.0-6.0	0.08-0.10	7.9-8.4	Low----------	----			
613, 613B, 613C--Rossfield	0-13	22-26	1.40-1.45	0.6-2.0	0.21-0.23	6.1-7.3	Low----------	0.32	4	6	3-4
	13-29	25-32	1.50-1.70	0.6-2.0	0.18-0.20	6.1-7.3	Low----------	0.32			
	29-60	10-15	1.70-1.90	2.0-6.0	0.10-0.12	7.4-8.4	Low----------	0.10			
614B, 614C3------Jacwin Variant	0-16	22-34	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	7	4-5
	16-28	40-60	1.50-1.60	<0.06	0.12-0.14	7.4-7.8	Moderate-----	0.43			
	28-60	---	1.70-1.80	---	---	---	-------------	---			
621--------------Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	---	3	>20
638C2*, 638D2*:											
Clarion---------	0-13	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	5	6	3-4
	13-36	24-30	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.8	Low----------	0.37			
	36-63	12-22	1.70-1.80	0.6-2.0	0.17-0.19	7.4-8.4	Low----------	0.37			
Storden---------	0-8	18-27	1.35-1.45	0.6-2.0	0.20-0.22	7.4-8.4	Low----------	0.28	5	4L	.5-1
	8-60	18-27	1.35-1.65	0.6-2.0	0.17-0.19	7.4-8.4	Low----------	0.37			
651--------------Faxon	0-23	28-35	1.20-1.40	0.6-2.0	0.17-0.22	6.6-7.8	Moderate-----	0.28	4	6	5-7
	23-36	18-30	1.40-1.60	0.6-2.0	0.12-0.19	6.6-7.8	Moderate-----	0.28			
	36	---	---	---	---	---	-------------	----			
695--------------Tilfer	0-17	27-32	1.35-1.40	0.6-2.0	0.20-0.22	7.4-8.4	Moderate-----	0.28	4	6	5-6
	17-32	16-30	1.40-1.65	0.6-2.0	0.17-0.19	6.6-8.4	Moderate-----	0.28			
	32	---	---	---	---	---	-------------	----			
706, 706B--------Cerlin	0-14	22-26	1.30-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	4	6	4-5
	14-31	27-34	1.40-1.50	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	31-63	40-55	1.70-1.80	<0.06	0.11-0.14	5.6-7.3	High---------	0.37			
	63-90	25-45	1.70-1.85	0.06-0.2	0.14-0.17	6.1-7.3	High---------	0.37			
725--------------Hayfield	0-13	18-28	1.30-1.50	0.6-2.0	0.20-0.24	5.1-6.5	Low----------	0.32	5	6	2-4
	13-27	18-30	1.40-1.55	0.6-2.0	0.17-0.22	5.1-6.0	Low----------	0.32			
	27-60	<5	1.55-1.65	6.0-20	0.02-0.04	5.6-7.8	Low----------	0.15			
733--------------Calco	0-37	28-33	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High---------	0.28	5	7	5-7
	37-53	22-32	1.30-1.45	0.6-2.0	0.18-0.20	7.4-8.4	Moderate-----	0.28			
	53-60	2-10	1.55-1.65	6.0-20	0.08-0.13	7.4-8.4	Low----------	0.20			
755--------------Nicollet	0-23	24-35	1.15-1.25	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.24	5	6	4-8
	23-29	24-35	1.25-1.35	0.6-2.0	0.15-0.19	5.6-7.8	Moderate-----	0.32			
	29-60	22-28	1.35-1.45	0.6-2.0	0.14-0.19	7.4-7.8	Low----------	0.32			
777, 777B, 777C2-Wapsie	0-8	12-18	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Low----------	0.28	4	6	1-2
	8-28	12-18	1.45-1.50	0.6-2.0	0.15-0.17	5.6-6.0	Low----------	0.28			
	28-60	2-10	1.50-1.75	>20.0	0.02-0.06	5.1-7.3	Low----------	0.10			
782, 782B, 782C2-Donnan	0-7	20-26	1.45-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.28	4	6	2-3
	7-32	28-34	1.45-1.55	0.6-2.0	0.17-0.19	5.1-5.5	Moderate-----	0.28			
	32-60	42-55	1.65-1.80	<0.06	0.11-0.14	5.6-6.5	High---------	0.28			
836B, 836C2------Kilkenny	0-8	27-30	1.15-1.25	0.2-0.6	0.17-0.19	5.6-7.3	Moderate-----	0.28	5	6	2-4
	8-34	35-45	1.25-1.35	0.2-0.6	0.15-0.19	4.5-6.5	Moderate-----	0.28			
	34-71	25-35	1.35-1.45	0.2-2.0	0.14-0.16	5.6-7.8	Moderate-----	0.37			
855--------------Shorewood	0-16	30-40	1.20-1.40	0.2-0.6	0.18-0.22	5.6-7.3	Moderate-----	0.37	4	7	4-8
	16-44	38-50	1.20-1.35	0.06-0.6	0.13-0.16	5.1-6.5	High---------	0.37			
	44-66	35-45	1.25-1.55	0.2-2.0	0.14-0.16	6.6-7.8	Moderate-----	0.37			
936*:											
Coland----------	0-42	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28	5	7	5-7
	42-52	12-26	1.50-1.65	2.0-6.0	0.13-0.17	6.1-7.3	Low----------	0.28			
	52-62	2-8	1.65-1.75	6.0-20	0.08-0.10	6.1-7.3	Low----------	0.17			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
936*:											
Hanlon----------	0-48	12-15	1.50-1.70	2.0-6.0	0.16-0.18	6.6-7.3	Low----------	0.20	5	3	2-4
	48-72	5-10	1.70-1.75	2.0-6.0	0.11-0.13	5.6-7.3	Low----------	0.20			
956*:											
Okoboji---------	0-29	35-42	1.25-1.30	0.2-0.6	0.21-0.23	6.6-7.8	High---------	0.37	5	4	9-11
	29-60	35-42	1.30-1.35	0.2-0.6	0.18-0.20	6.6-7.8	High---------	0.37			
Harps-----------	0-16	25-35	1.35-1.40	0.6-2.0	0.19-0.21	7.9-8.4	Moderate-----	0.24	5	4L	4-5
	16-46	18-32	1.40-1.50	0.6-2.0	0.17-0.19	7.9-8.4	Moderate-----	0.32			
	46-65	20-26	1.50-1.70	0.6-2.0	0.17-0.19	7.9-8.4	Moderate-----	0.32			
976-------------- Raddle	0-15	18-24	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5-4	6	3-4
	15-65	18-24	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43			
1936*:											
Coland----------	0-42	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High---------	0.28	5	7	5-7
	42-52	12-26	1.50-1.65	2.0-6.0	0.13-0.17	6.1-7.3	Low----------	0.28			
	52-60	2-8	1.65-1.75	6.0-20	0.08-0.10	6.1-7.3	Low----------	0.17			
Hanlon----------	0-48	12-15	1.50-1.70	2.0-6.0	0.16-0.18	6.6-7.3	Low----------	0.20	5	3	2-4
	48-72	5-10	1.70-1.75	2.0-6.0	0.11-0.13	5.6-7.3	Low----------	0.20			
5010*, 5030*. Pits											
5040*. Orthents											
5060*. Pits											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
6----------------- Okoboji	B/D	None---------	---	---	+1-1.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
27B--------------- Terril	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
29*:												
Clarion----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Nicollet---------	B	None---------	---	---	2.5-5.0	Apparent	Apr-May	>60	---	High-----	High-----	Low.
41B, 41C---------- Sparta	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
55---------------- Nicollet	B	None---------	---	---	2.5-5.0	Apparent	Apr-May	>60	---	High-----	High-----	Low.
62C3, 62D3, 62E3-- Storden	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
73C, 73E---------- Salida	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
83, 83B, 83C2----- Kenyon	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
84---------------- Clyde	B/D	Frequent----	Very brief	Feb-Nov	1.0-2.5	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
95---------------- Harps	B/D	None---------	---	---	1.0-3.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
107--------------- Webster	B/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
135--------------- Coland	B/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
138, 138B, 138C, 138C2, 138D2----- Clarion	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
151, 152---------- Marshan	B/D	None---------	---	---	1.0-2.5	Apparent	Oct-Jun	>60	---	High-----	High-----	Moderate.
153--------------- Shandep	B/D	Frequent----	Brief to long.	Mar-Nov	0-1.0	Apparent	Jan-Dec	>60	---	High-----	High-----	Moderate.
169B-------------- Clarion	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
171, 171B, 171C2, 171D2, 171F------ Bassett	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
173--------------- Hoopeston	B	None--------	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High-----	Low------	Moderate.
174, 174B--------- Bolan	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
175, 175B--------- Dickinson	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
177, 177B, 177C, 177C2------------ Saude	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
178, 178B--------- Waukee	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
184--------------- Klinger	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
188--------------- Kensett	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	24-40	Hard	High-----	High-----	Low.
198B-------------- Floyd	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
201B*:												
Coland-----------	B/D	Frequent----	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
Terril-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
213, 213B, 214, 214B, 214C------- Rockton	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low------	Low.
216B, 217, 217B--- Ripon	B	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate	Moderate.
221, 221B--------- Palms	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
225, 226---------- Lawler	B	None--------	---	---	2.0-4.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
236B, 236C, 236C2, 236D2, 236E2, 236F------------- Lester	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
274--------------- Rolfe	C	None--------	---	---	+1-1.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
284---------------- Flagler	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate	Low.
284B, 284C--------- Flagler	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate	Low.
325---------------- Le Sueur	B	None---------	---	---	2.0-4.0	Perched	Nov-May	>60	---	High------	High------	Low.
329*:												
Webster-----------	B/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High------	High------	Low.
Nicollet----------	B	None---------	---	---	2.5-5.0	Apparent	Apr-May	>60	---	High------	High------	Low.
335---------------- Harcot	B/D	Rare---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High------	High------	Low.
354*:												
Aquolls.												
Histosols.												
377, 377B---------- Dinsdale	B	None---------	---	---	>6.0	---	---	>60	---	High------	Moderate	Moderate.
382---------------- Maxfield	B/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High------	High------	Moderate.
391B*:												
Clyde-------------	B/D	Frequent-----	Very brief	Feb-Nov	1.0-2.5	Apparent	Nov-Jul	>60	---	High------	High------	Low.
Floyd-------------	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High------	High------	Low.
398---------------- Tripoli	B/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High------	High------	Moderate.
399---------------- Readlyn	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	High------	Moderate.
407B--------------- Schley	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	High------	High.
412C, 412E--------- Sogn	D	None---------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low-------	Low.
444---------------- Jacwin	B	None---------	---	---	2.0-4.0	Perched	Nov-Jun	40-60	Soft	High------	High------	Low.
457---------------- Du Page	B	Occasional	Brief------	Apr-Jun	4.0-6.0	Apparent	Feb-Jun	>60	---	Moderate	Low-------	Low.
471---------------- Oran	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	High------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
507----------------- Canisteo	C/D	None---------	---	---	1.0-3.0	Apparent	Oct-Jul	>60	---	High-----	High-----	Low.
536----------------- Hanlon	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jun	>60	---	Moderate	Moderate	Low.
551----------------- Calamine	D	None---------	---	---	+.5-1.0	Perched	Nov-May	20-40	Soft	Moderate	High-----	Moderate.
558, 559----------- Talcot	B/D	None---------	---	---	1.0-2.5	Apparent	Apr-Jul	>60	---	High-----	High-----	Low.
583----------------- Minnetonka	D	None---------	---	---	0-3.0	Perched	Apr-Jun	>60	---	High-----	High-----	Moderate.
611----------------- Rossfield Variant	B	None---------	---	---	2.0-4.0	Perched	Nov-Jul	20-40	Soft	High-----	High-----	Low.
612B, 612C2, 612E2, 612G2----- Mottland	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
613, 613B, 613C--- Rossfield	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
614B, 614C3------- Jacwin Variant	---	None---------	---	---	>6.0	---	---	20-40	Soft	High-----	High-----	Low.
621----------------- Houghton	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	High-----	High-----	Low.
638C2*, 638D2*:												
Clarion-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Storden-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
651----------------- Faxon	B/D	Occasional	Very brief	Apr-May	0-1.0	Apparent	Nov-May	20-40	Hard	High-----	High-----	Low.
695----------------- Tilfer	B/D	Occasional	Brief-----	Feb-Nov	1.0-2.0	Apparent	Nov-Jul	20-40	Hard	High-----	High-----	Low.
706, 706B---------- Cerlin	C	None---------	---	---	2.0-3.0	Perched	Nov-Jul	>60	---	High-----	---	---
725----------------- Hayfield	B	None---------	---	---	2.5-5.0	Apparent	Apr-Jun	>60	---	High-----	Low------	Moderate.
733----------------- Calco	B/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
755----------------- Nicollet	B	None---------	---	---	2.5-5.0	Apparent	Apr-May	>60	---	High-----	High-----	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
777, 777B, 777C2-- Wapsie	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
782, 782B, 782C2-- Donnan	C	None--------	---	---	2.0-3.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
836B, 836C2------- Kilkenny	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
855--------------- Shorewood	C	None--------	---	---	3.0-5.0	Perched	Apr-Jun	>60	---	High-----	High-----	Moderate.
936*:												
Coland-----------	B/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
Hanlon-----------	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jun	>60	---	Moderate	Moderate	Low.
956*:												
Okoboji----------	B/D	None--------	---	---	+1-1.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
Harps------------	B/D	None--------	---	---	1.0-3.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
976--------------- Raddle	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
1936*:												
Coland-----------	B/D	Frequent----	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
Hanlon-----------	B	Frequent----	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jun	>60	---	Moderate	Moderate	Low.
5010*, 5030*. Pits												
5040*. Orthents												
5060*. Pits												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Aquolls	Loamy, mixed, mesic Typic Haplaquolls
Bassett	Fine-loamy, mixed, mesic Mollic Hapludalfs
Bolan	Coarse-loamy, mixed, mesic Typic Hapludolls
Calamine	Fine, mixed, mesic Typic Argiaquolls
Calco	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Canisteo	Fine-loamy, mixed (calcareous), mesic Typic Haplaquolls
Cerlin	Fine-loamy over clayey, mixed, mesic Aquic Argiudolls
Clarion	Fine-loamy, mixed, mesic Typic Hapludolls
Clyde	Fine-loamy, mixed, mesic Typic Haplaquolls
Coland	Fine-loamy, mixed, mesic Cumulic Haplaquolls
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
*Dinsdale	Fine-silty, mixed, mesic Typic Argiudolls
Donnan	Fine-loamy over clayey, mixed, mesic Aquollic Hapludalfs
Du Page	Fine-loamy, mixed, mesic Cumulic Hapludolls
Faxon	Fine-loamy, mixed, mesic Typic Haplaquolls
Flagler	Coarse-loamy, mixed, mesic Typic Hapludolls
Floyd	Fine-loamy, mixed, mesic Aquic Hapludolls
Hanlon	Coarse-loamy, mixed, mesic Cumulic Hapludolls
Harcot	Fine-loamy over sandy or sandy-skeletal, mesic Typic Calciaquolls
Harps	Fine-loamy, mesic Typic Calciaquolls
Hayfield	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquollic Hapludalfs
Histosols	Euic, mesic Medisaprists
Hoopeston	Coarse-loamy, mixed, mesic Aquic Hapludolls
Houghton	Euic, mesic Typic Medisaprists
*Jacwin	Fine-loamy over clayey, mixed, mesic Aquic Hapludolls
Jacwin Variant	Fine-loamy, mixed, mesic Typic Hapludolls
Kensett	Fine-loamy, mixed, mesic Aquic Hapludolls
Kenyon	Fine-loamy, mixed, mesic Typic Hapludolls
Kilkenny	Fine, montmorillonitic, mesic Mollic Hapludalfs
Klinger	Fine-silty, mixed, mesic Aquic Hapludolls
Lawler	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquic Hapludolls
*Le Sueur	Fine-loamy, mixed, mesic Aquic Argiudolls
Lester	Fine-loamy, mixed, mesic Mollic Hapludalfs
Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Maxfield	Fine-silty, mixed, mesic Typic Haplaquolls
Minnetonka	Fine, montmorillonitic, mesic Typic Argiaquolls
Mottland	Coarse-loamy, carbonatic, mesic Entic Hapludolls
Nicollet	Fine-loamy, mixed, mesic Aquic Hapludolls
Okoboji	Fine, montmorillonitic, mesic Cumulic Haplaquolls
Oran	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Orthents	Loamy, mixed, mesic Udorthents
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Raddle	Fine-silty, mixed, mesic Typic Hapludolls
Readlyn	Fine-loamy, mixed, mesic Aquic Hapludolls
*Ripon	Fine-silty, mixed, mesic Typic Argiudolls
Rockton	Fine-loamy, mixed, mesic Typic Argiudolls
Rolfe	Fine, montmorillonitic, mesic Typic Argialbolls
Rossfield	Fine-loamy, mixed, mesic Typic Hapludolls
Rossfield Variant	Fine-silty, mixed, mesic Aquic Hapludolls
Salida	Sandy-skeletal, mixed, mesic Entic Hapludolls
Saude	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Schley	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Shandep	Fine-loamy, mixed, mesic Cumulic Haplaquolls
Shorewood	Fine, montmorillonitic, mesic Aquic Argiudolls
*Sogn	Loamy, mixed, mesic Lithic Haplustolls
Sparta	Sandy, mixed, mesic Entic Hapludolls
Storden	Fine-loamy, mixed (calcareous), mesic Typic Udorthents
Talcot	Fine-loamy over sandy or sandy-skeletal, mixed (calcareous), mesic Typic Haplaquolls
Terril	Fine-loamy, mixed, mesic Cumulic Hapludolls
Tilfer	Fine-loamy, mixed (calcareous), mesic Typic Haplaquolls
Tripoli	Fine-loamy, mixed, mesic Typic Haplaquolls
Wapsie	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs
Waukee	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Webster	Fine-loamy, mixed, mesic Typic Haplaquolls

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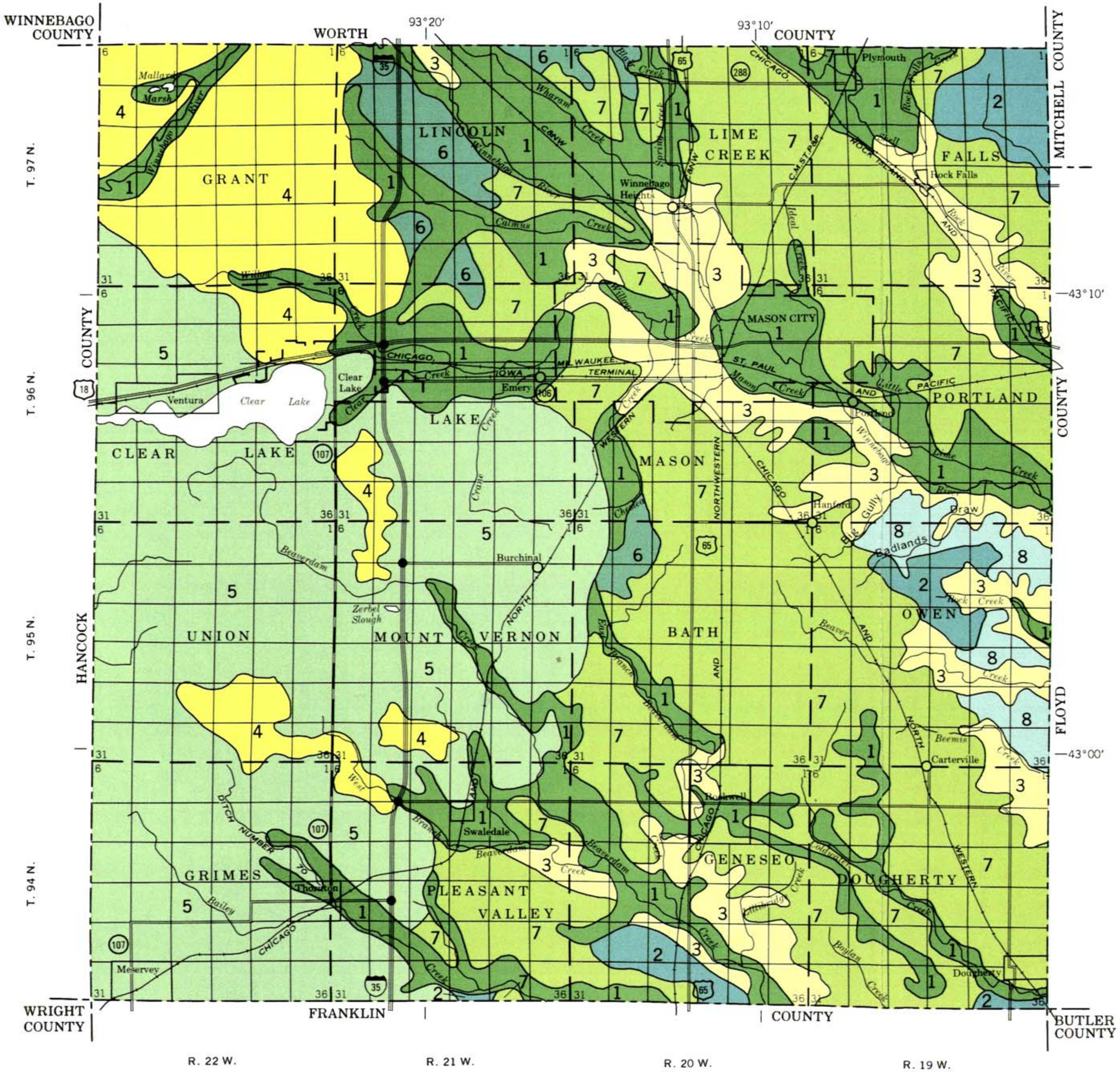


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
IOWA AGRICULTURE AND HOME ECONOMICS EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE, IOWA STATE UNIVERSITY
DEPARTMENT OF SOIL CONSERVATION, STATE OF IOWA

GENERAL SOIL MAP

CERRO GORDO COUNTY, IOWA

Scale 1:190,080

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SOIL LEGEND

1 Saude-Marshan-Lawler association: Nearly level to moderately sloping, well drained, poorly drained, and somewhat poorly drained soils that formed in loamy and sandy alluvium; on stream benches and uplands

2 Dinsdale-Klinger-Maxfield association: Nearly level to gently sloping, well drained, somewhat poorly drained, and poorly drained soils that formed in loess and the underlying glacial till; on uplands

3 Rockton-Sogn-Mottland association: Nearly level to very steep, well drained and somewhat excessively drained soils that formed in loamy sediment over limestone bedrock; on stream benches and uplands

4 Lester-Webster-Nicollet association: Nearly level to steep, well drained, poorly drained, and somewhat poorly drained soils that formed in glacial till and local alluvium derived from glacial till; on uplands

5 Clarion-Webster-Nicollet association: Nearly level to strongly sloping, well drained, poorly drained, and somewhat poorly drained soils that formed in glacial till and local alluvium derived from glacial till; on uplands

6 Clarion-Nicollet association: Gently sloping and very gently sloping, well drained and somewhat poorly drained soils that formed in glacial till; on uplands

7 Clyde-Kenyon-Floyd association: Nearly level to moderately sloping, poorly drained, moderately well drained, and somewhat poorly drained soils that formed in loamy surficial sediment and the underlying glacial till; on uplands and in drainageways

8 Rossfield-Rockton-Ripon association: Nearly level to moderately sloping, well drained soils that formed in loess or in loamy glacial sediment over limestone bedrock; on uplands

Compiled 1980

SECTIONALIZED TOWNSHIP

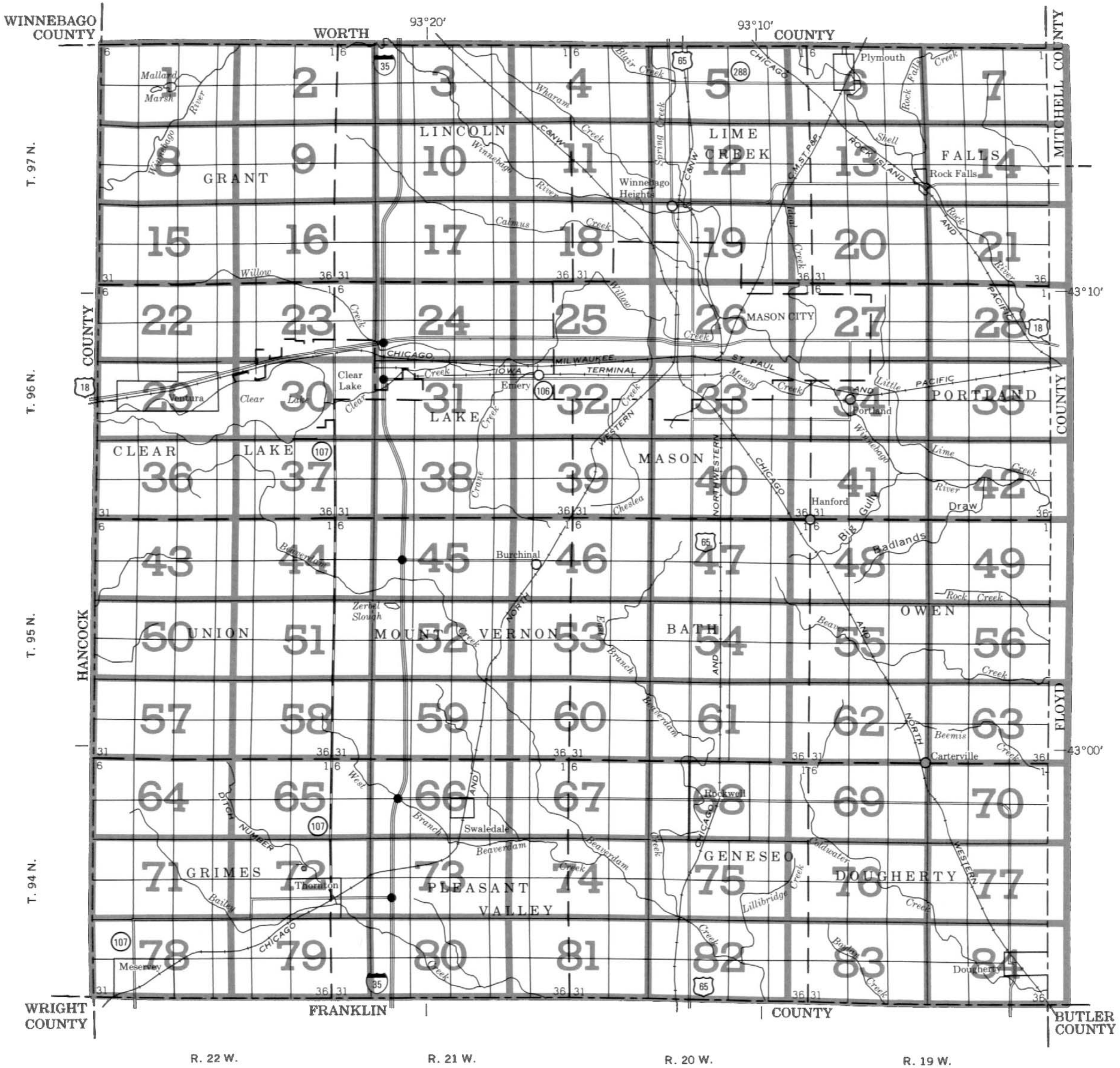
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

INDEX TO MAP SHEETS

CERRO GORDO COUNTY, IOWA

Scale 1:190,080



Original text from each individual map sheet read:
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and letters. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous area. A final number of 2 following the slope letter indicates that the soil is moderately eroded and 3 that it is severely eroded.

SYMBOL	NAME
6	Okoboji silty clay loam, 0 to 1 percent slopes
27B	Terril loam, 2 to 5 percent slopes
29	Clarion–Nicollet loams, 1 to 3 percent slopes
41B	Sparta loamy fine sand, 2 to 5 percent slopes
41C	Sparta loamy fine sand, 5 to 9 percent slopes
55	Nicollet loam, 1 to 3 percent slopes
62C3	Storden loam, 5 to 9 percent slopes, severely eroded
62D3	Storden loam, 9 to 14 percent slopes, severely eroded
62E3	Storden loam, 14 to 18 percent slopes, severely eroded
73C	Salida sandy loam, 2 to 9 percent slopes
73E	Salida sandy loam, 9 to 18 percent slopes
83	Kenyon loam, 0 to 2 percent slopes
83B	Kenyon loam, 2 to 5 percent slopes
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded
84	Clyde silty clay loam, 0 to 2 percent slopes
95	Harps loam, 1 to 3 percent slopes
107	Webster silty clay loam, 0 to 2 percent slopes
135	Coland clay loam, 0 to 2 percent slopes
138	Clarion loam, 0 to 2 percent slopes
138B	Clarion loam, 2 to 5 percent slopes
138C	Clarion loam, 5 to 9 percent slopes
138C2	Clarion loam, 5 to 9 percent slopes, moderately eroded
138D2	Clarion loam, 9 to 14 percent slopes, moderately eroded
151	Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
152	Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
153	Shandep clay loam, 0 to 1 percent slopes
169B	Clarion loam, 2 to 5 percent long slopes
171	Bassett loam, 0 to 2 percent slopes
171B	Bassett loam, 2 to 5 percent slopes
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded
171D2	Bassett loam, 9 to 14 percent slopes, moderately eroded
171F	Bassett loam, 14 to 25 percent slopes
173	Hoopeston fine sandy loam, 1 to 3 percent slopes
174	Bolan loam, 0 to 2 percent slopes
174B	Bolan loam, 2 to 5 percent slopes
175	Dickinson fine sandy loam, 0 to 2 percent slopes
175B	Dickinson fine sandy loam, 2 to 5 percent slopes
177	Saude loam, 0 to 2 percent slopes
177B	Saude loam, 2 to 5 percent slopes
177C	Saude loam, 5 to 9 percent slopes
177C2	Saude loam, 5 to 9 percent slopes, moderately eroded
178	Waukee loam, 0 to 2 percent slopes
178B	Waukee loam, 2 to 5 percent slopes
184	Klinger silty clay loam, 1 to 3 percent slopes
188	Kensett loam, 0 to 2 percent slopes
198B	Floyd loam, 1 to 4 percent slopes
201B	Coland–Terril complex, 1 to 4 percent slopes
213	Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes
213B	Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
214	Rockton loam, 20 to 30 inches to limestone, 0 to 2 percent slopes
214B	Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes
214C	Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes
216B	Ripon silt loam, 20 to 30 inches to limestone, 1 to 5 percent slopes
217	Ripon silt loam, 30 to 40 inches to limestone, 0 to 2 percent slopes
217B	Ripon silt loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
221	Palms muck, 0 to 1 percent slopes
221B	Palms muck, 1 to 4 percent slopes
225	Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
236B	Lester loam, 2 to 5 percent slopes
236C	Lester loam, 5 to 9 percent slopes
236C2	Lester loam, 5 to 9 percent slopes, moderately eroded
236D2	Lester loam, 9 to 14 percent slopes, moderately eroded
236E2	Lester loam, 14 to 18 percent slopes, moderately eroded
236F	Lester loam, 18 to 25 percent slopes
274	Rolfe silt loam, 0 to 1 percent slopes
284	Flagler sandy loam, 0 to 2 percent slopes
284B	Flagler sandy loam, 2 to 5 percent slopes
284C	Flagler sandy loam, 5 to 9 percent slopes
325	Le Sueur loam, 1 to 3 percent slopes
329	Webster–Nicollet complex, 1 to 3 percent slopes
335	Harcot loam, 0 to 2 percent slopes
354	Aquolls and Histosols
377	Dinsdale silty clay loam, 0 to 2 percent slopes
377B	Dinsdale silty clay loam, 2 to 5 percent slopes
382	Maxfield silty clay loam, 0 to 2 percent slopes
391B	Clyde–Floyd complex, 1 to 4 percent slopes
398	Tripoli silty clay loam, 0 to 2 percent slopes
399	Readlyn loam, 1 to 3 percent slopes
407B	Schley loam, 1 to 4 percent slopes
412C	Sogn loam, 2 to 9 percent slopes
412E	Sogn loam, 9 to 18 percent slopes
444	Jacwin silty clay loam, 1 to 3 percent slopes
457	Du Page silt loam, 0 to 2 percent slopes
471	Oran silt loam, 1 to 3 percent slopes
507	Canisteo silty clay loam, 0 to 2 percent slopes
536	Hanlon fine sandy loam, 0 to 2 percent slopes
551	Calamine silty clay loam, 1 to 3 percent slopes
558	Talcot clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
559	Talcot clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
583	Minnetonka silty clay loam, 0 to 2 percent slopes
611	Rossfield Variant silty clay loam, 1 to 3 percent slopes
612B	Mottland loam, 2 to 5 percent slopes
612C2	Mottland loam, 5 to 9 percent slopes, moderately eroded
612E2	Mottland loam, 9 to 18 percent slopes, moderately eroded
612G2	Mottland loam, 18 to 40 percent slopes, moderately eroded
613	Rossfield silt loam, 0 to 2 percent slopes
613B	Rossfield silt loam, 2 to 5 percent slopes
613C	Rossfield silt loam, 5 to 9 percent slopes
614B	Jacwin Variant loam, 2 to 5 percent slopes
614C3	Jacwin Variant silty clay loam, 5 to 9 percent slopes, severely eroded
621	Houghton muck, 0 to 1 percent slopes
638C2	Clarion–Storden loams, 5 to 9 percent slopes, moderately eroded
638D2	Clarion–Storden loams, 9 to 14 percent slopes, moderately eroded
651	Faxon silty clay loam, 0 to 2 percent slopes
695	Tilfer silty clay loam, 0 to 2 percent slopes
706	Cerlin silt loam, 0 to 2 percent slopes
706B	Cerlin silt loam, 2 to 5 percent slopes
725	Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
733	Calco silty clay loam, 0 to 2 percent slopes
755	Nicollet loam, 1 to 3 percent long slopes
777	Wapsie loam, 0 to 2 percent slopes
777B	Wapsie loam, 2 to 5 percent slopes
777C2	Wapsie loam, 5 to 9 percent slopes, moderately eroded
782	Donnan loam, 0 to 2 percent slopes
782B	Donnan loam, 2 to 5 percent slopes
782C2	Donnan loam, 5 to 9 percent slopes, moderately eroded
836B	Kilkenny clay loam, 2 to 5 percent slopes
836C2	Kilkenny clay loam, 5 to 9 percent slopes, moderately eroded
855	Shorewood silty clay loam, 1 to 3 percent slopes
936	Coland–Hanlon complex, 0 to 2 percent slopes
956	Okoboji–Harps complex, 0 to 3 percent slopes
976	Raddle silt loam, 1 to 3 percent slopes
1936	Coland–Hanlon complex, channeled, 0 to 2 percent slopes
5010	Pits, sand and gravel
5030	Pits, limestone quarry
5040	Orthents, loamy
5060	Pits, clay

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 107; 83C2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

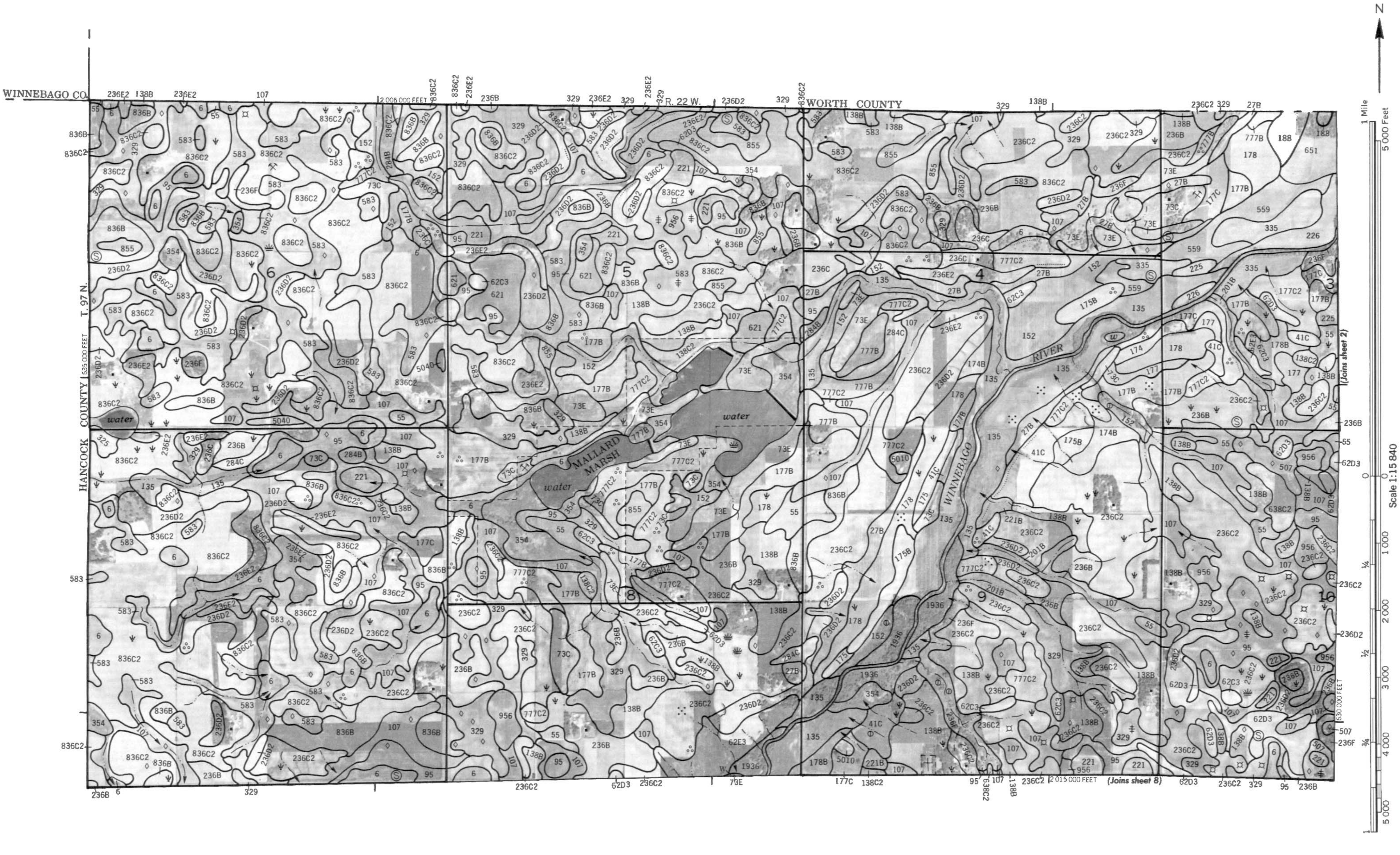
DEPRESSION OR SINK

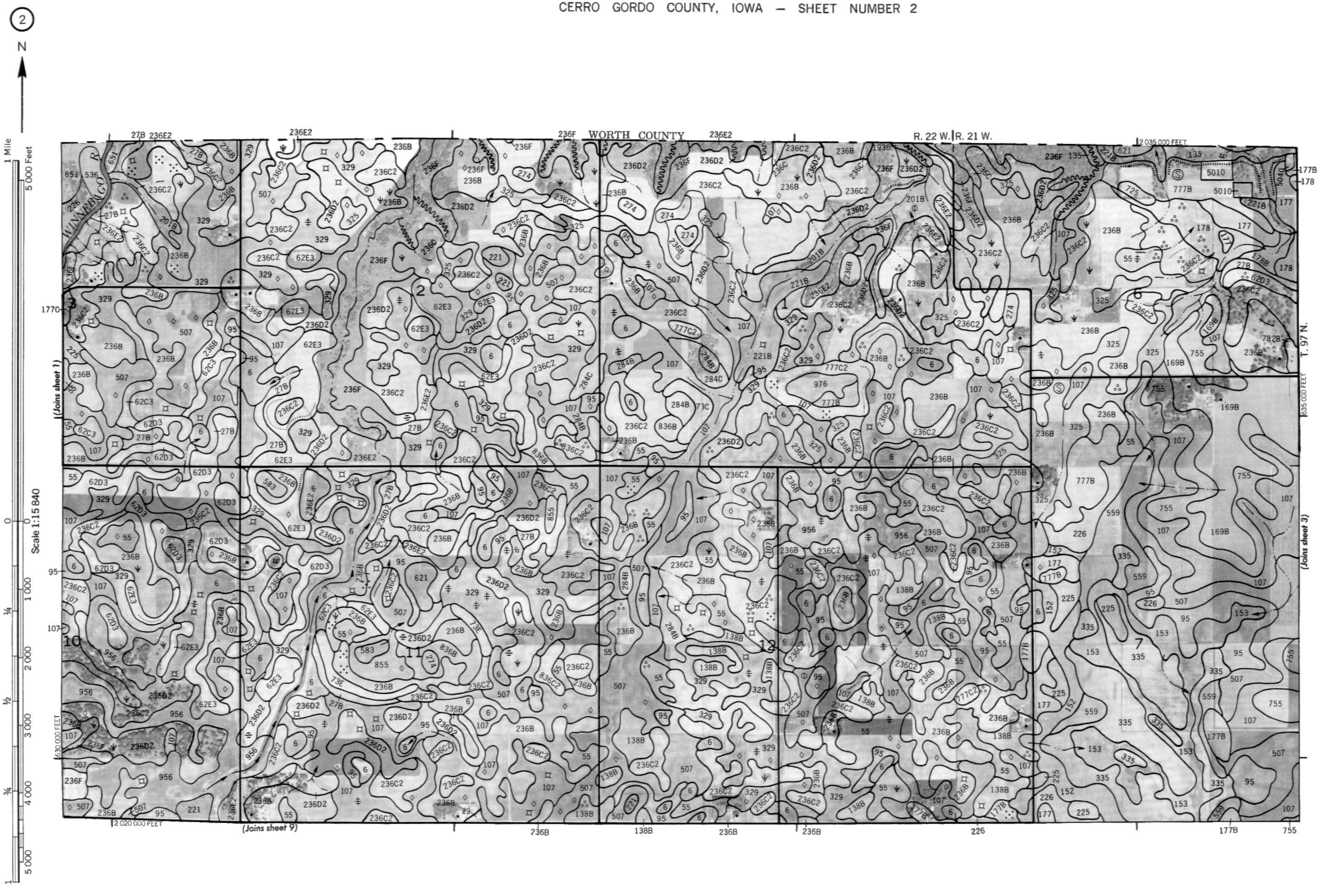
SOIL SAMPLE SITE (normally not shown) — S

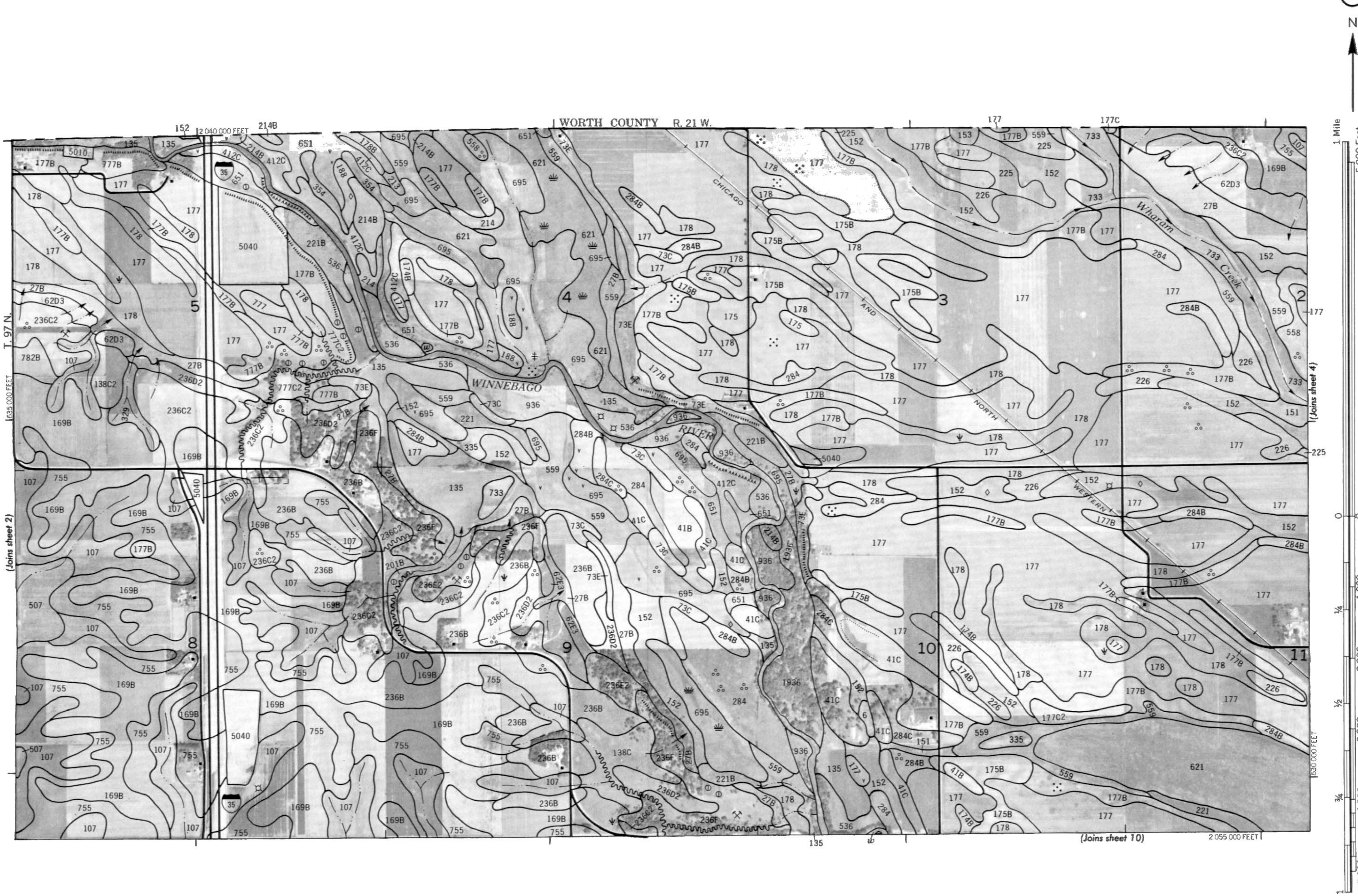
MISCELLANEOUS

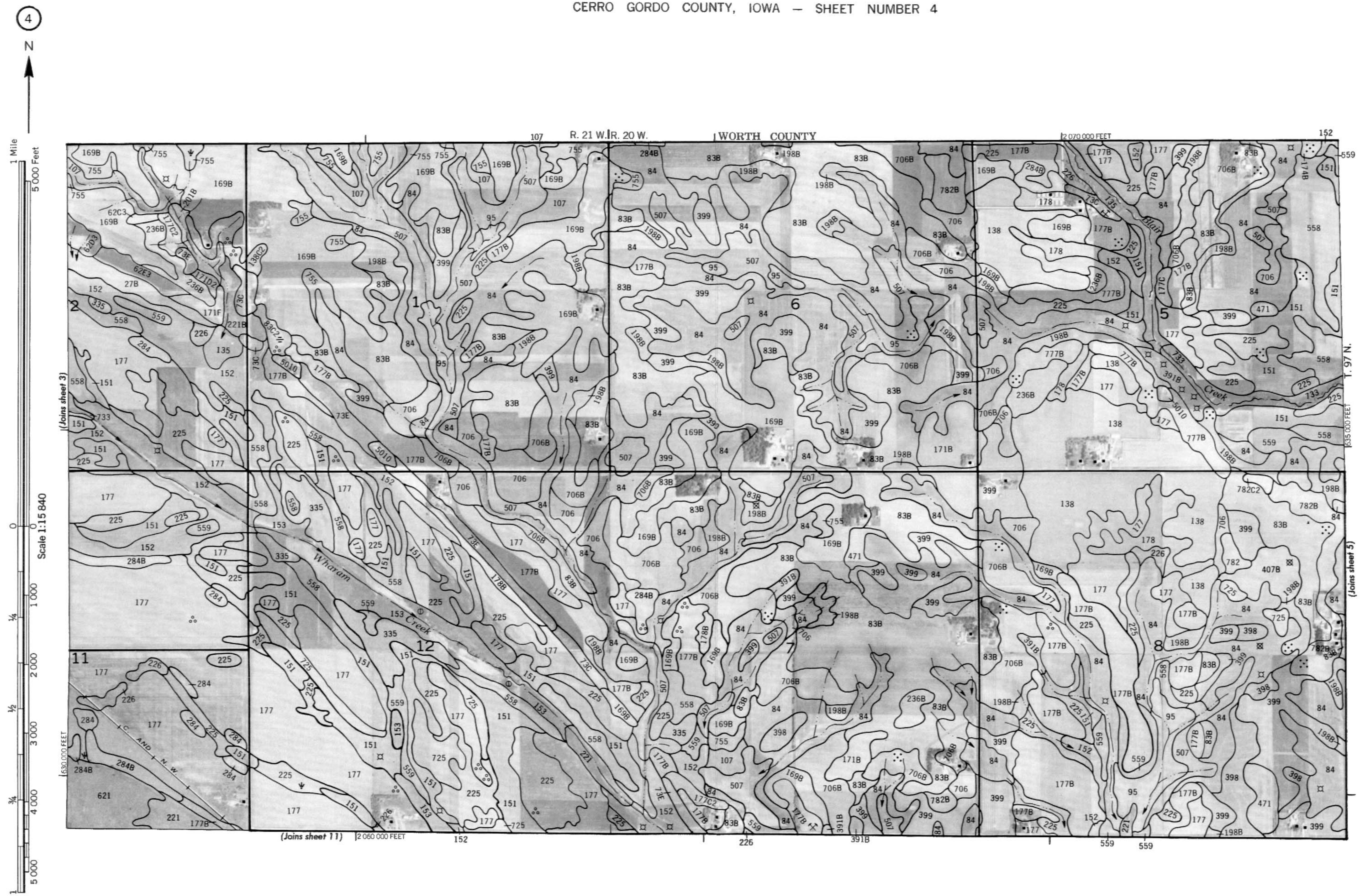
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Calcareous spot
- Dense gray clay at a depth of 20–36 inches
- Muck spot
- Well drained hump
- Shale outcrop
- Made land spot or borrow pit
- Sewage lagoon — S.L.

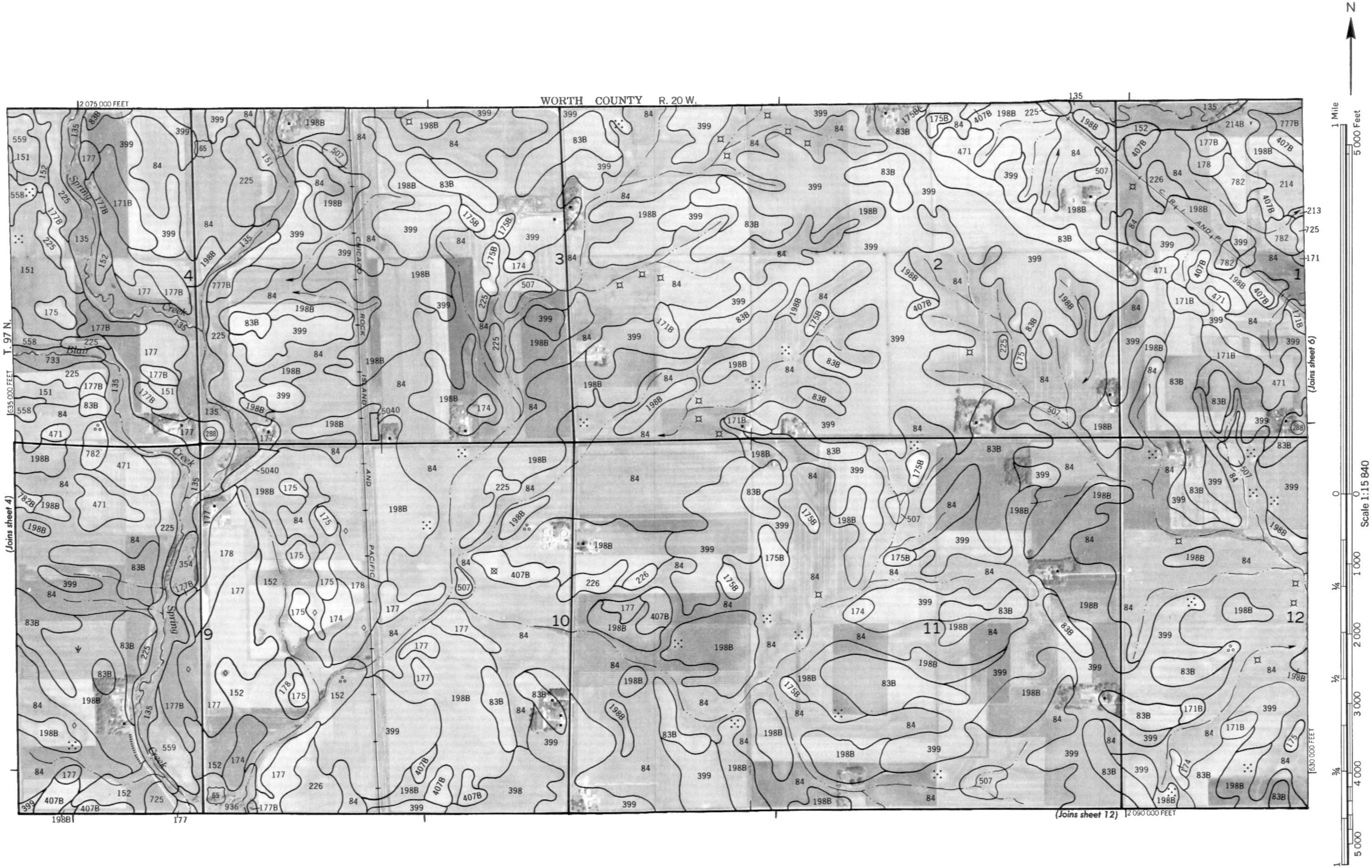
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 1




2
N
WORTH COUNTY
R. 22 W.
R. 21 W.
T. 97 N.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 9)
2 035 000 FEET
2 020 000 FEET
635 000 FEET
630 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
WINNEBAGO R.

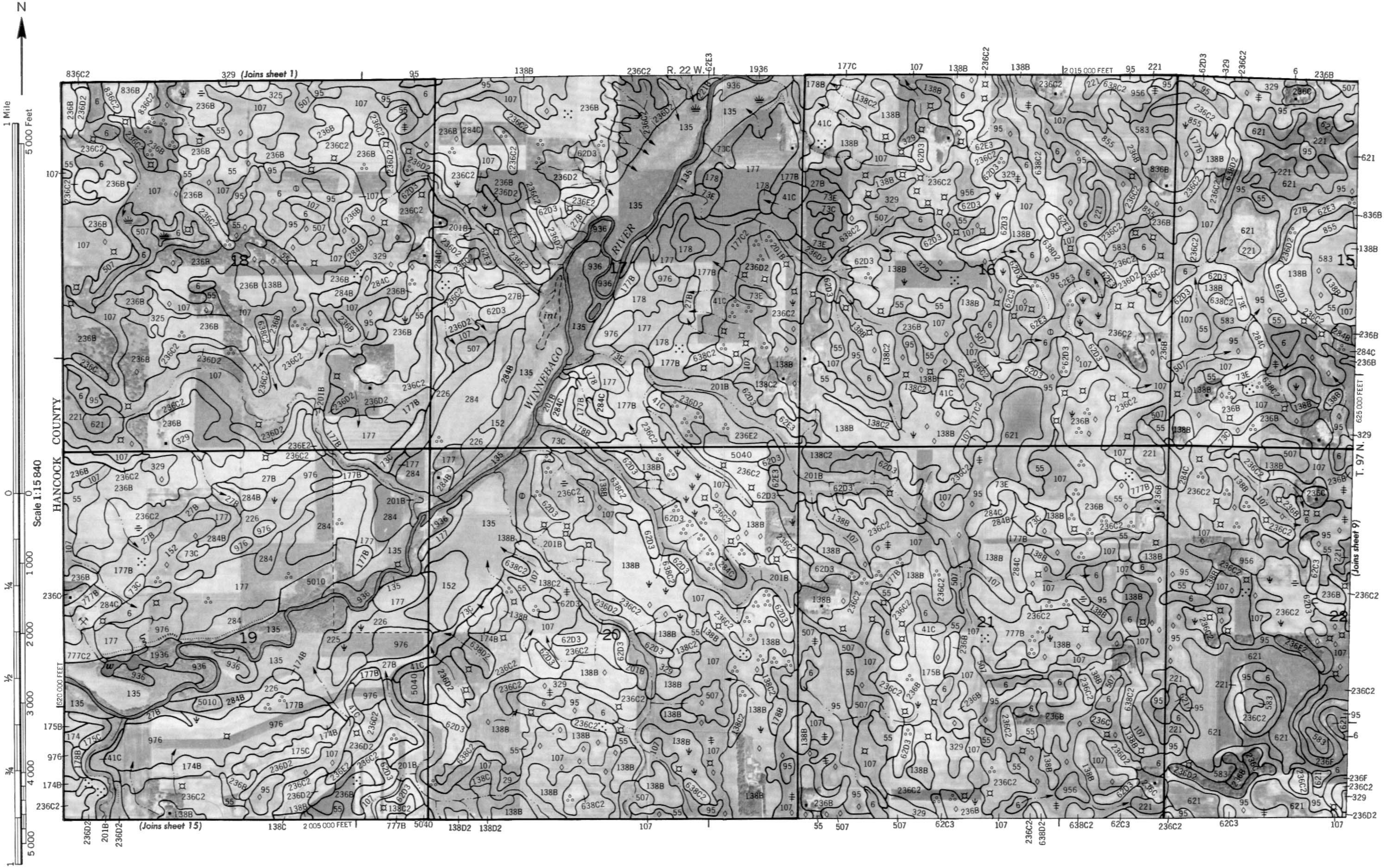

3
N
WORTH COUNTY
R. 21 W.
T. 97 N.
2 040 000 FEET
635 000 FEET
630 000 FEET
2 055 000 FEET
WINNEBAGO
RIVER
Wharam Creek
CHICAGO AND NORTH WESTERN
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 10)
1 Mile
5 000 Feet
Scale 1:15 840

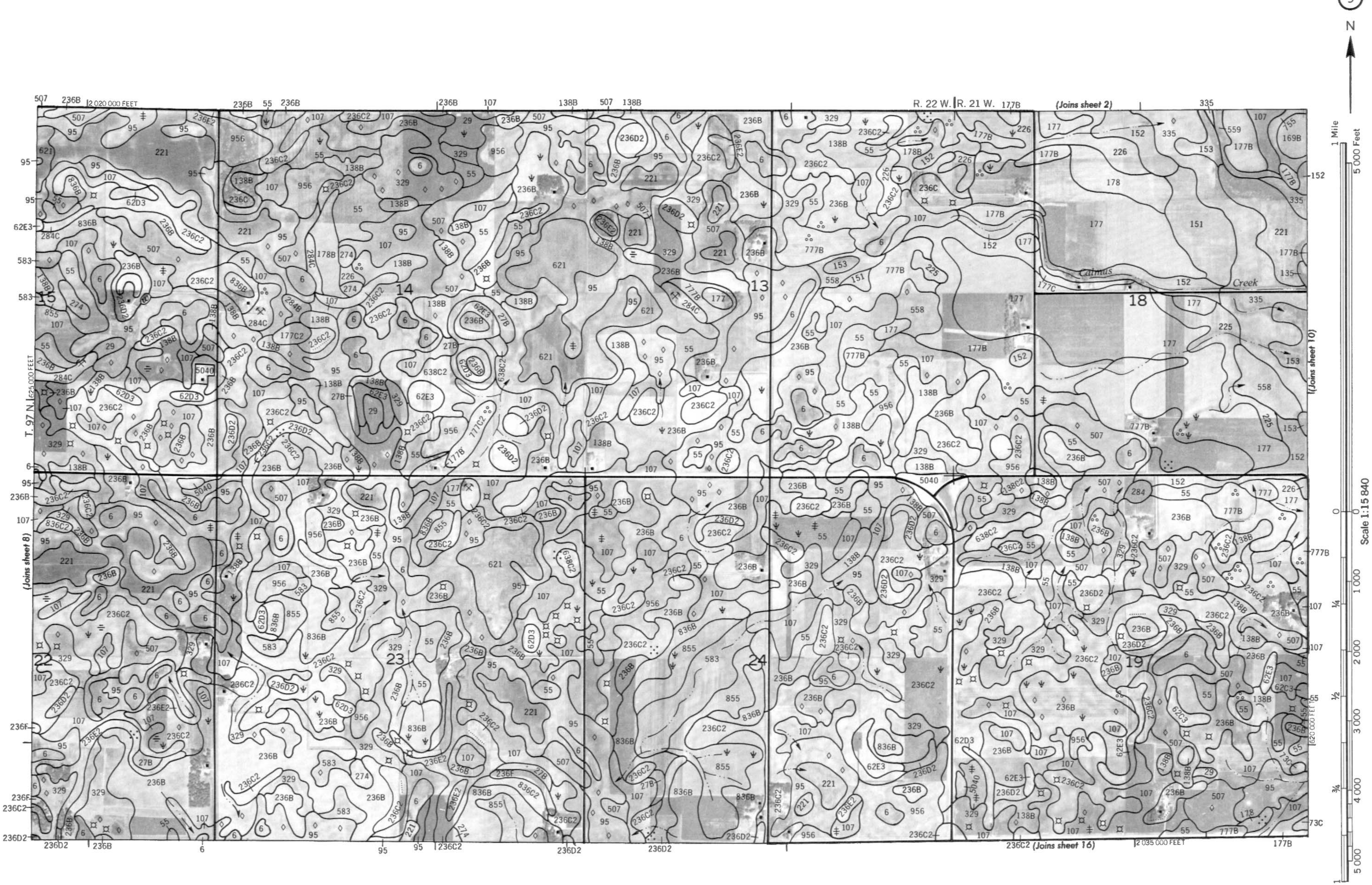

4
N
1 Mile
5 000 Feet
Scale 1:15 840
R. 21 W.
R. 20 W.
WORTH COUNTY
T. 97 N.
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 11)
2 070 000 FEET
2 060 000 FEET
635 000 FEET
630 000 FEET
Wharam Creek
Blair Creek
C. AND N. W.

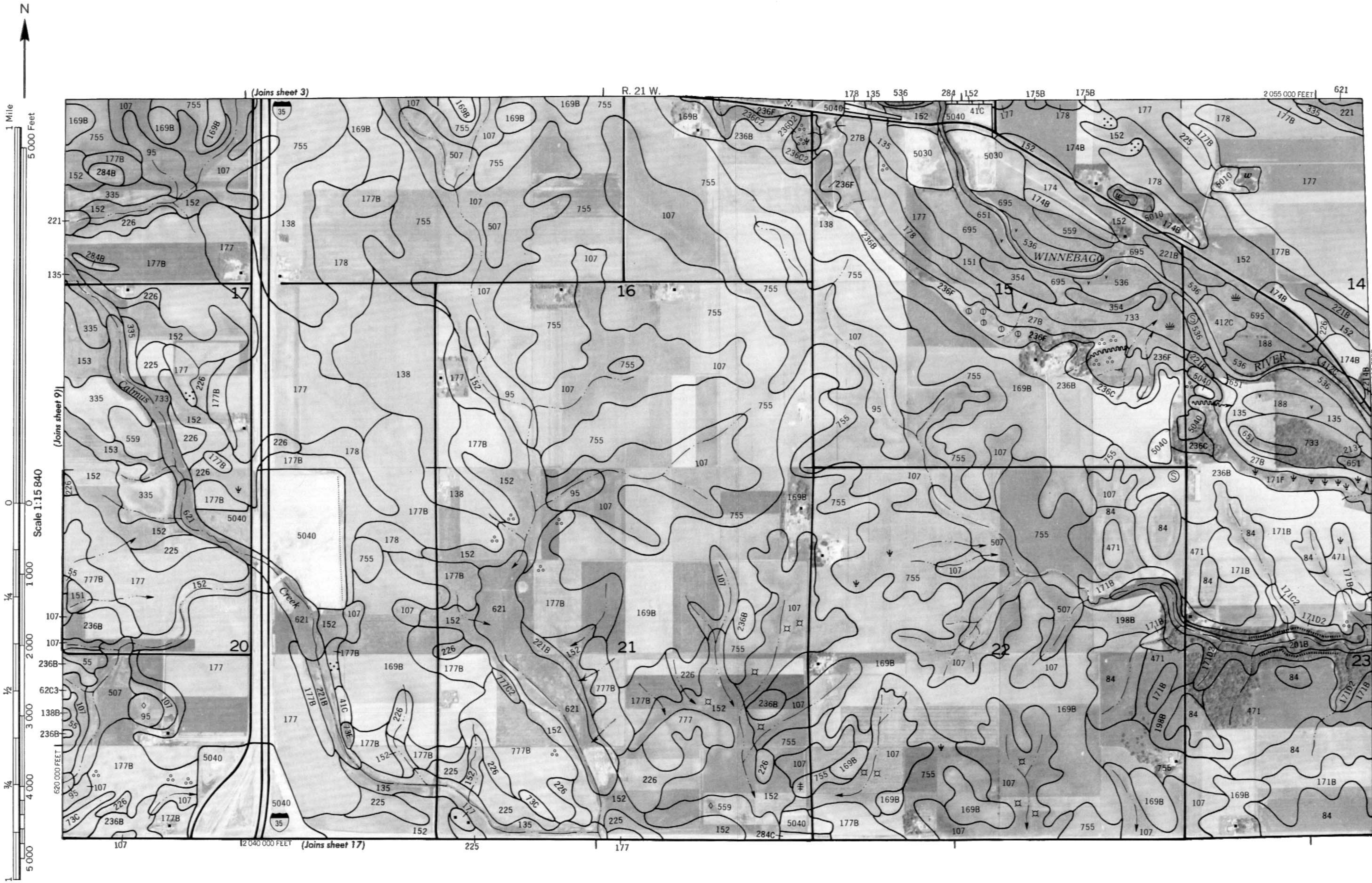

N
WORTH COUNTY
R. 20 W.
T. 97 N.
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 12)
2 075 000 FEET
2 090 000 FEET
635 000 FEET
630 000 FEET
Spring Creek
Blair
CHICAGO ROCK ISLAND AND PACIFIC
1 Mile
5 000 Feet
Scale 1:15 840

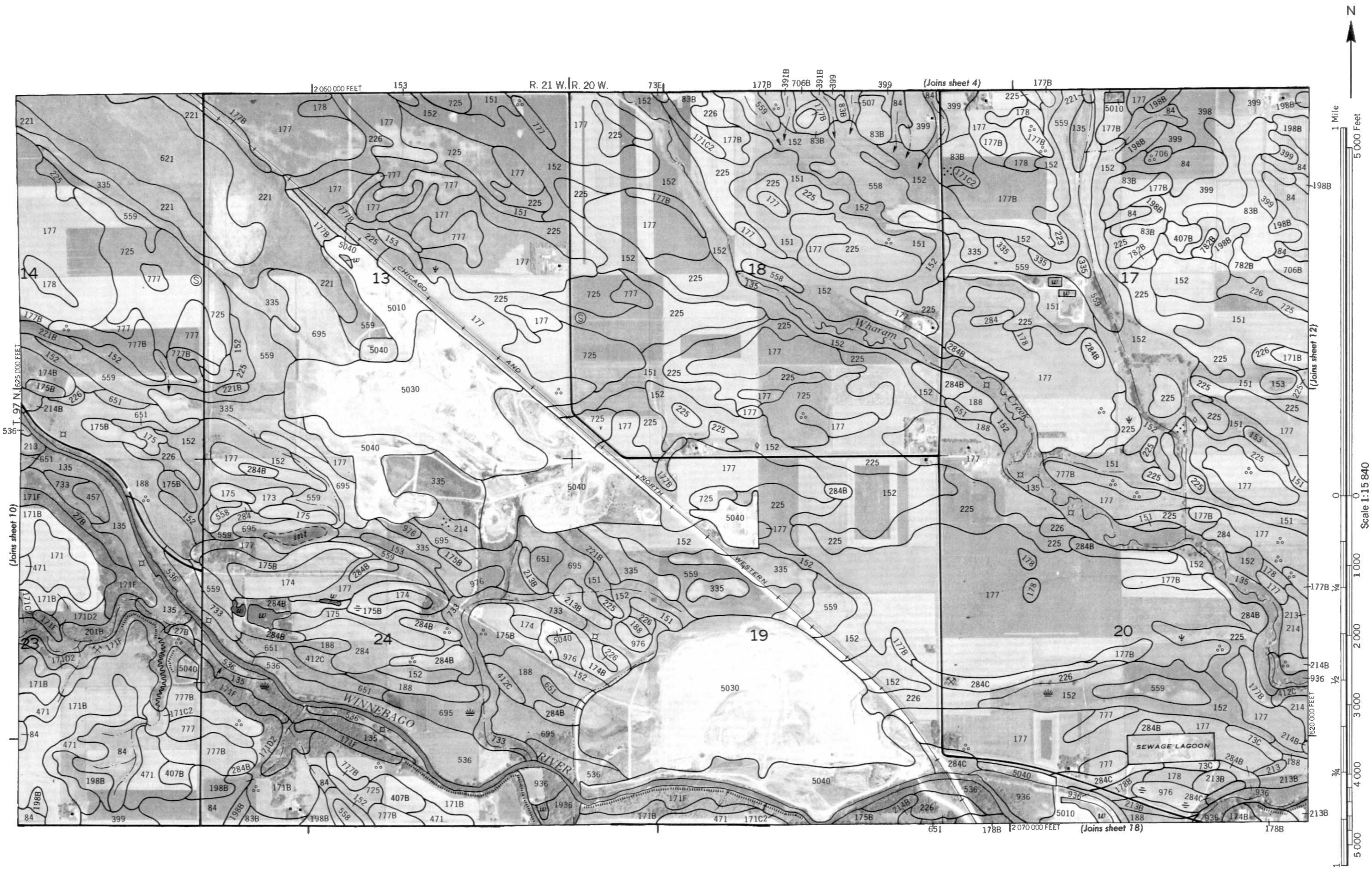
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 6


N
WORTH COUNTY
R. 19 W.
2 115 000 FEET
T. 97 N.
635 000 FEET
(Joins sheet 6)
MITCHELL COUNTY
198B
(Joins sheet 14)
2 125 000 FEET
630 000 FEET
Dramage Ditch
1180
1936
1 Mile
5 000 Feet
Scale 1:15 840

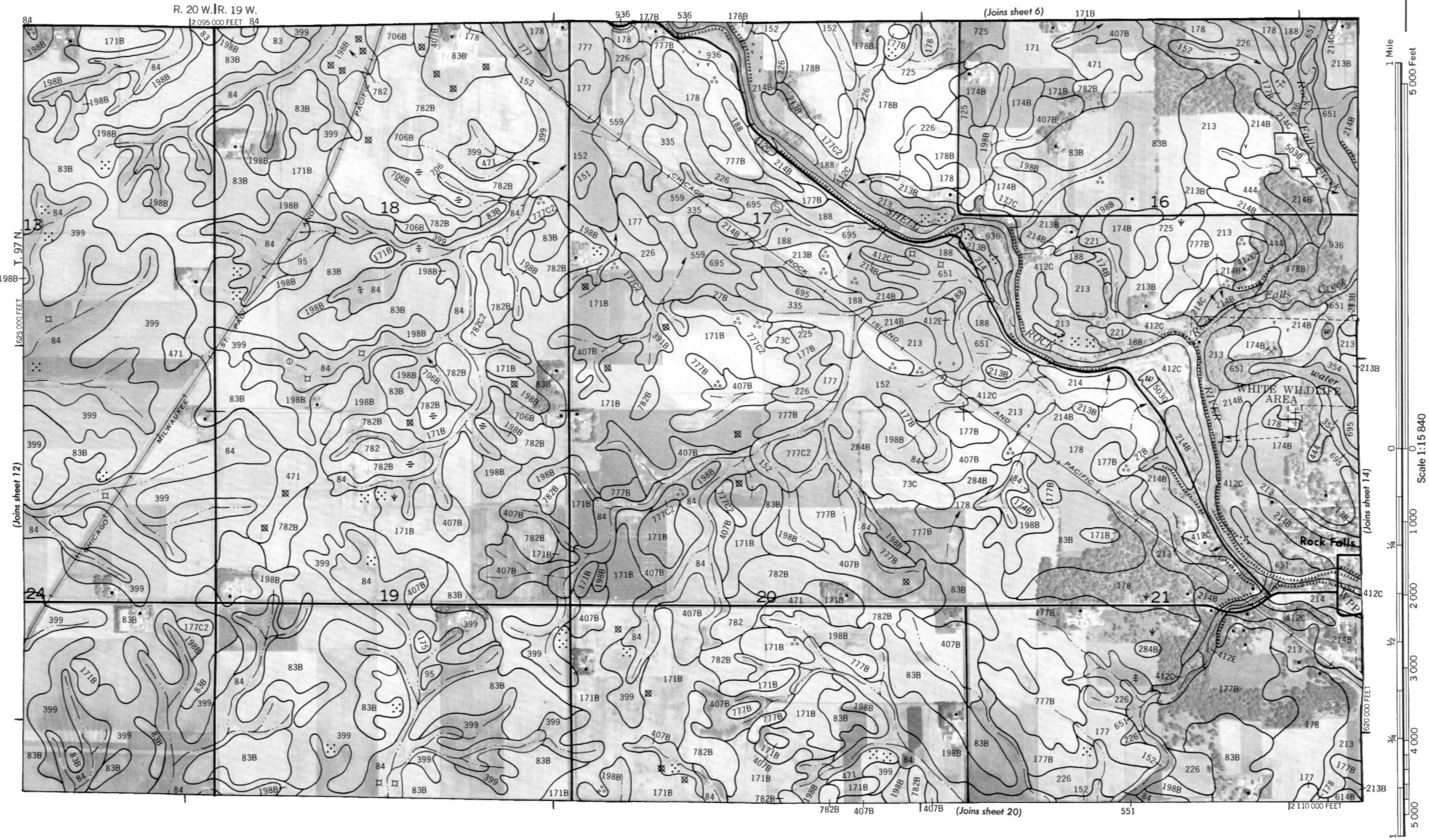

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 1)
(Joins sheet 15)
(Joins sheet 9)
R. 22 W.
T. 97 N.
HANCOCK COUNTY
WINNEBAGO RIVER
2 015 000 FEET
2 005 000 FEET
625 000 FEET
620 000 FEET
15
16
17
18
19
20
21
22

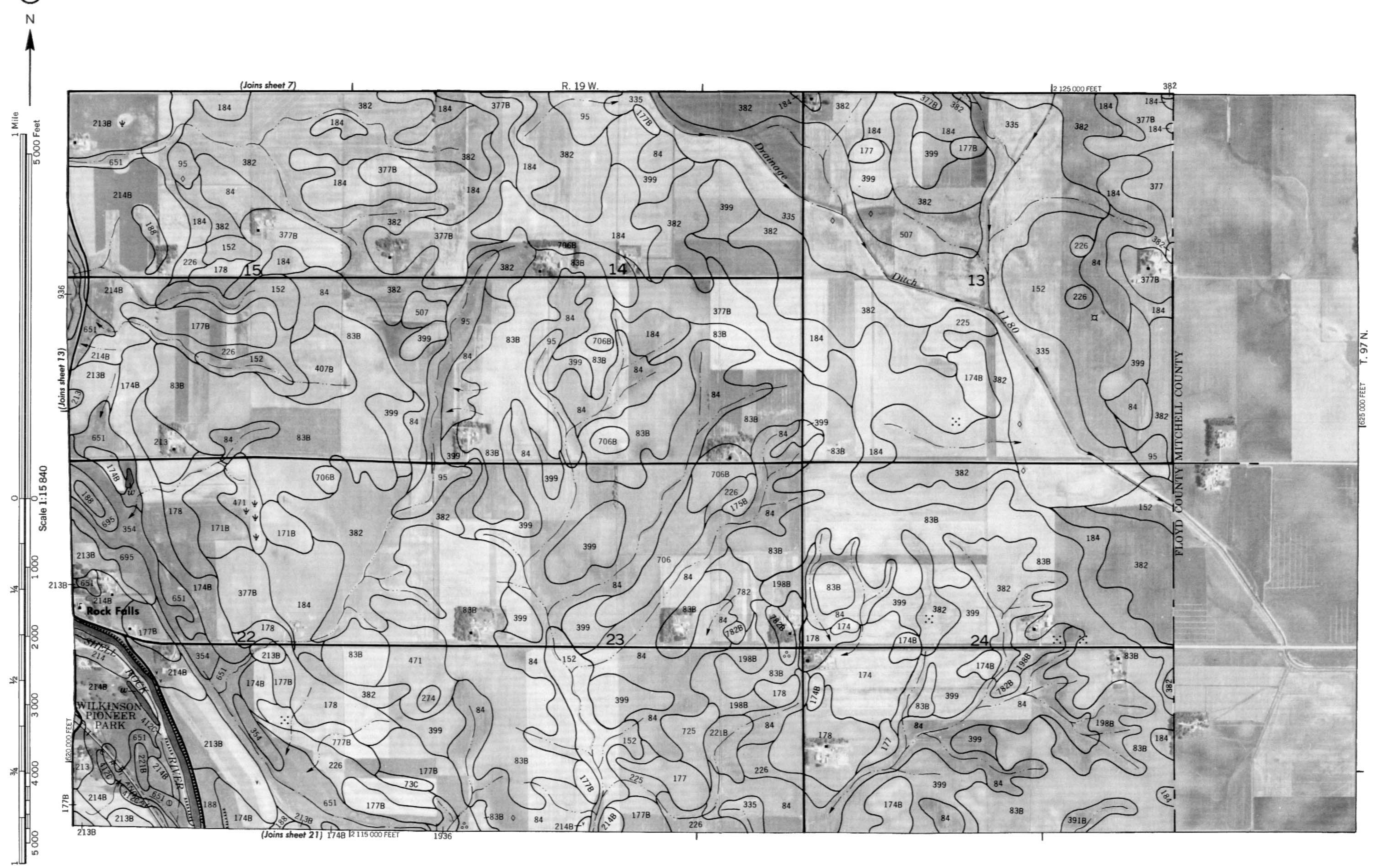

9
N
(Joins sheet 2)
R. 22 W.
R. 21 W.
2 020 000 FEET
2 035 000 FEET
625 000 FEET
620 000 FEET
T. 97 N.
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 16)
Calmus
Creek
15
14
13
18
22
23
24
19
1 Mile
5 000 Feet
Scale 1:15 840

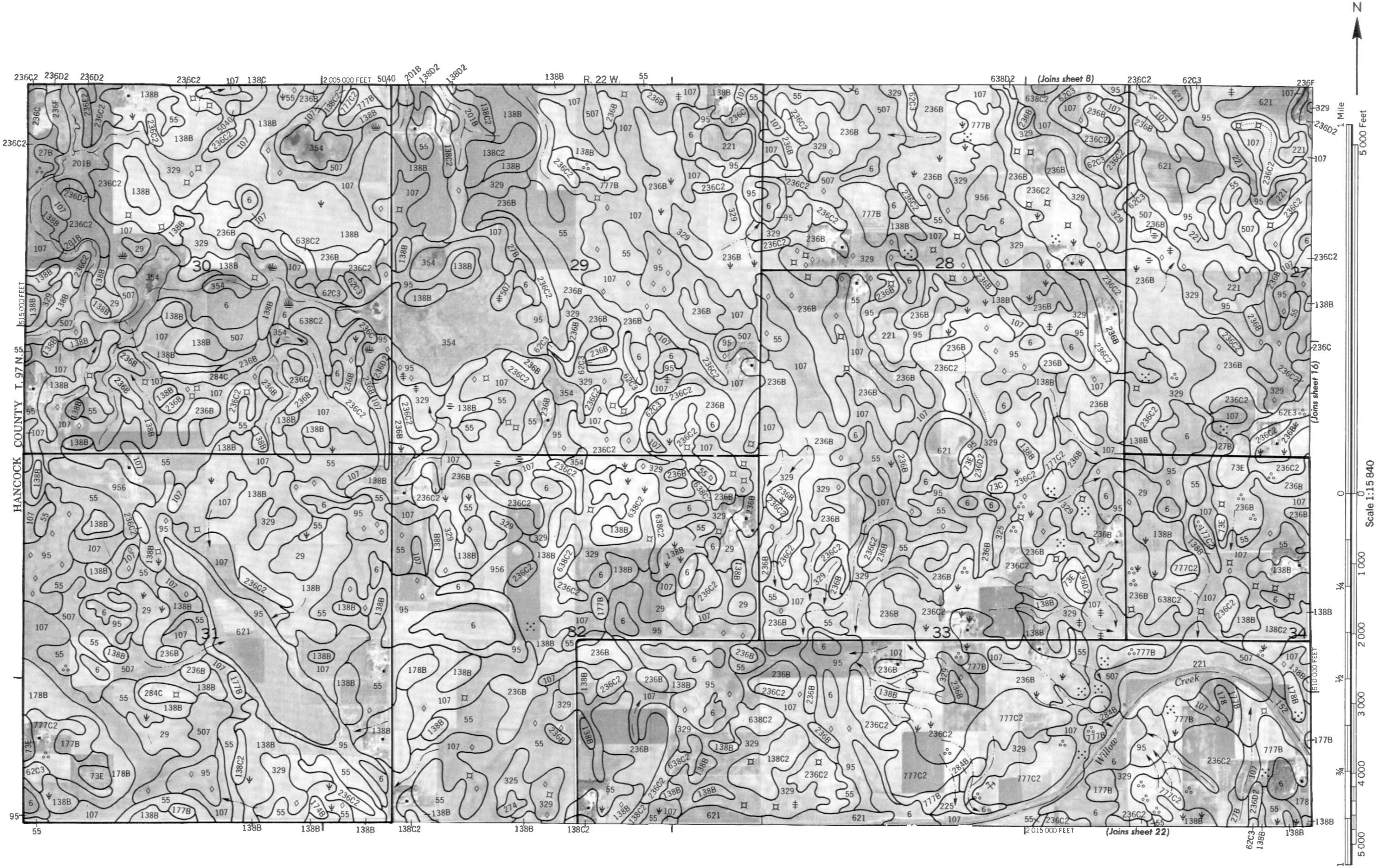

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 3)
R. 21 W.
2 055 000 FEET
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 17)
T. 97 N.
625 000 FEET
620 000 FEET
2 040 000 FEET
35
WINNEBAGO
RIVER
Calmus
Creek
14
15
16
17
20
21
22
23

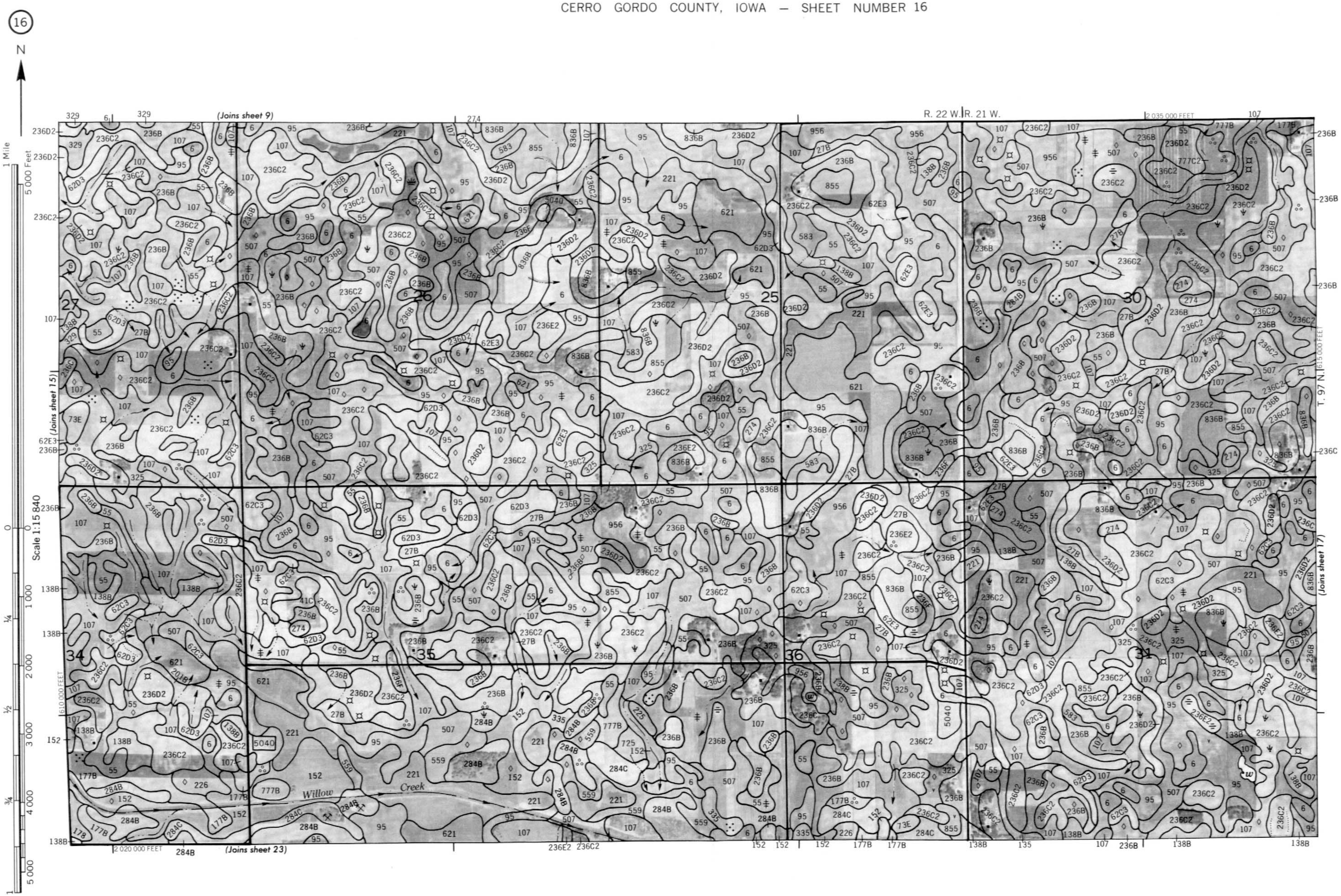

N
R. 21 W.
R. 20 W.
T. 97 N.
(Joins sheet 4)
(Joins sheet 12)
(Joins sheet 18)
(Joins sheet 10)
2 060 000 FEET
2 070 000 FEET
625 000 FEET
620 000 FEET
CHICAGO AND NORTH WESTERN
WINNEBAGO RIVER
Wharam Creek
SEWAGE LAGOON
14
13
18
17
23
24
19
20
1 Mile
5 000 Feet
Scale 1:15 840

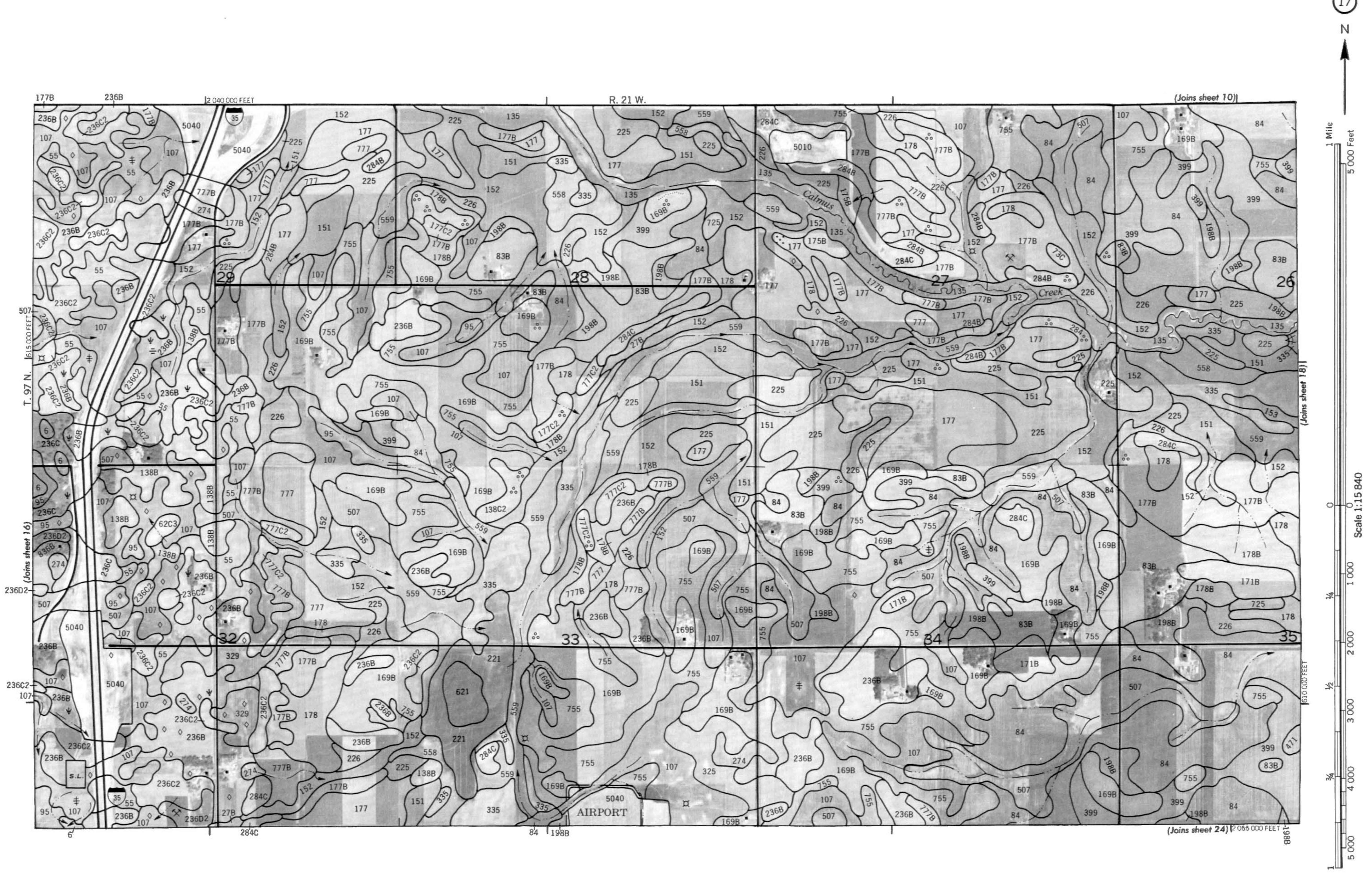

N
(Joins sheet 5)
R. 20 W.
2 090 000 FEET
T. 97 N.
625 000 FEET
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 19)
2 075 000 FEET
620 000 FEET
782B
Spring
Creek
CHICAGO ROCK ISLAND AND PACIFIC
Winnebago Heights
Scale 1:15 840
1 Mile
5 000 Feet
16
15
14
13
21
22
23
24


N
R. 20 W. | R. 19 W.
2 095 000 FEET
2 110 000 FEET
625 000 FEET
620 000 FEET
T. 97 N.
(Joins sheet 6)
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 20)
13
18
17
16
24
19
20
21
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
CHICAGO ROCK ISLAND AND PACIFIC
SHELL ROCK RIVER
Rock Falls Creek
Falls Creek
WHITE WILDLIFE AREA
Rock Falls
WPP
1 Mile
5 000 Feet
Scale 1:15 840

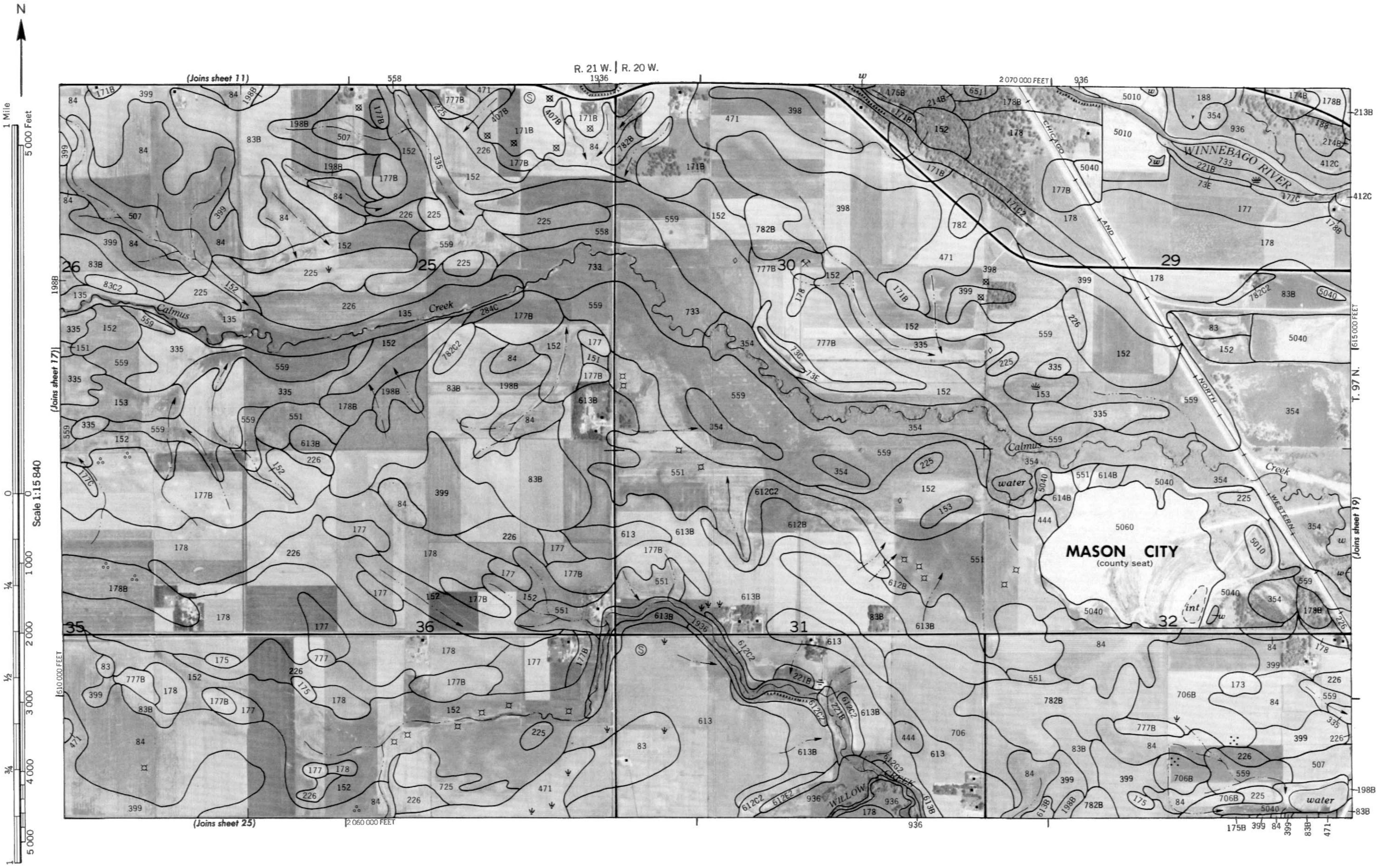

14
N
(Joins sheet 7)
R. 19 W.
(Joins sheet 13)
(Joins sheet 21)
T. 97 N.
Scale 1:15 840
1 Mile
5 000 Feet
Rock Falls
WILKINSON PIONEER PARK
SHELL ROCK RIVER
Drainage Ditch 1180
MITCHELL COUNTY
FLOYD COUNTY
2 125 000 FEET
2 115 000 FEET
625 000 FEET
620 000 FEET
15
14
13
22
23
24

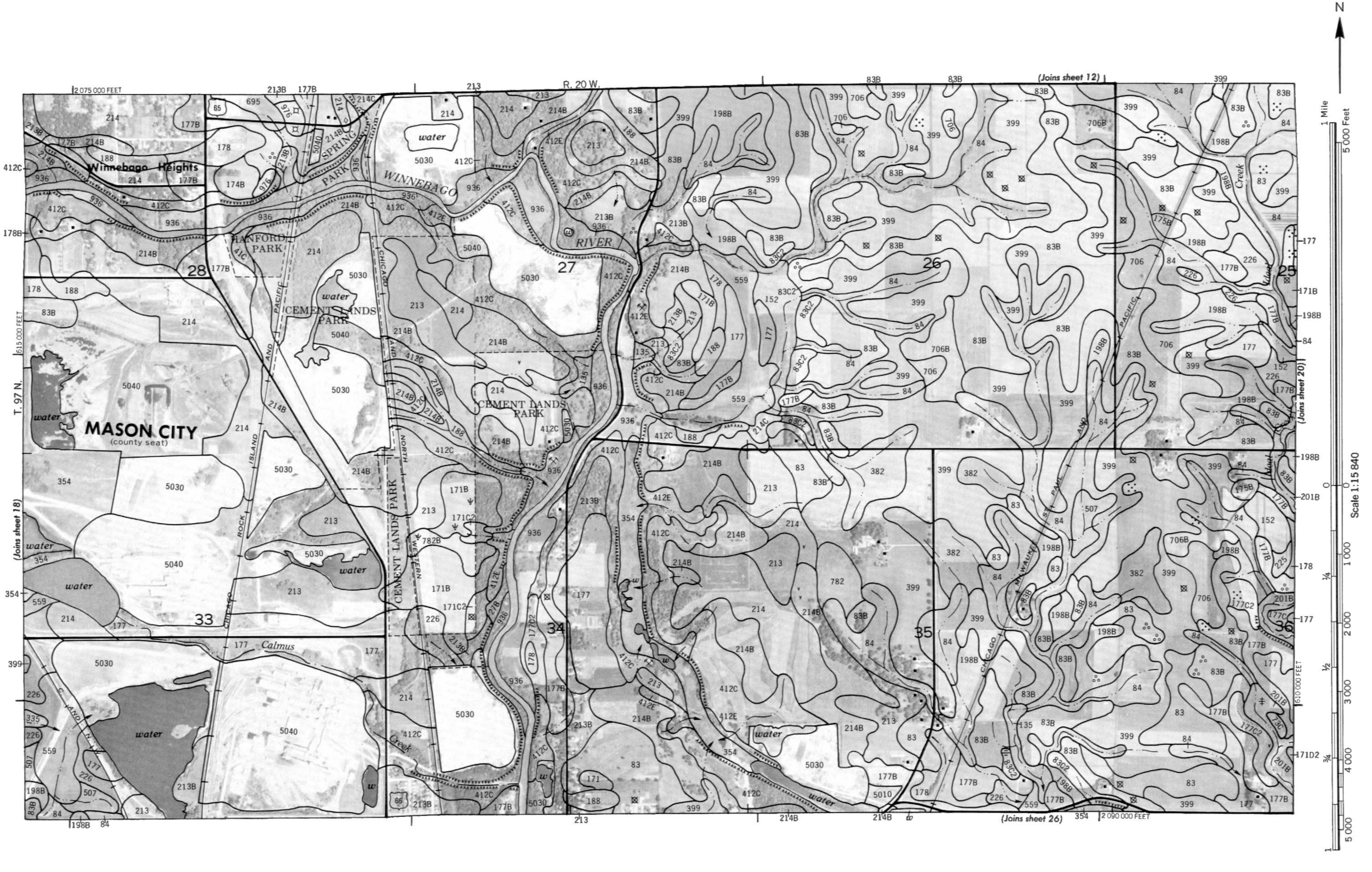

N
(Joins sheet 8)
R. 22 W.
2 005 000 FEET
HANCOCK COUNTY
T. 97 N.
615 000 FEET
(Joins sheet 16)
610 000 FEET
(Joins sheet 22)
2 015 000 FEET
30
29
28
27
31
32
33
34
Willow
Creek
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000


16
N
(Joins sheet 9)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 23)
R. 22 W.
R. 21 W.
T. 97 N.
2 035 000 FEET
2 020 000 FEET
610 000 FEET
615 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
27
26
25
30
34
35
36
31
Willow
Creek

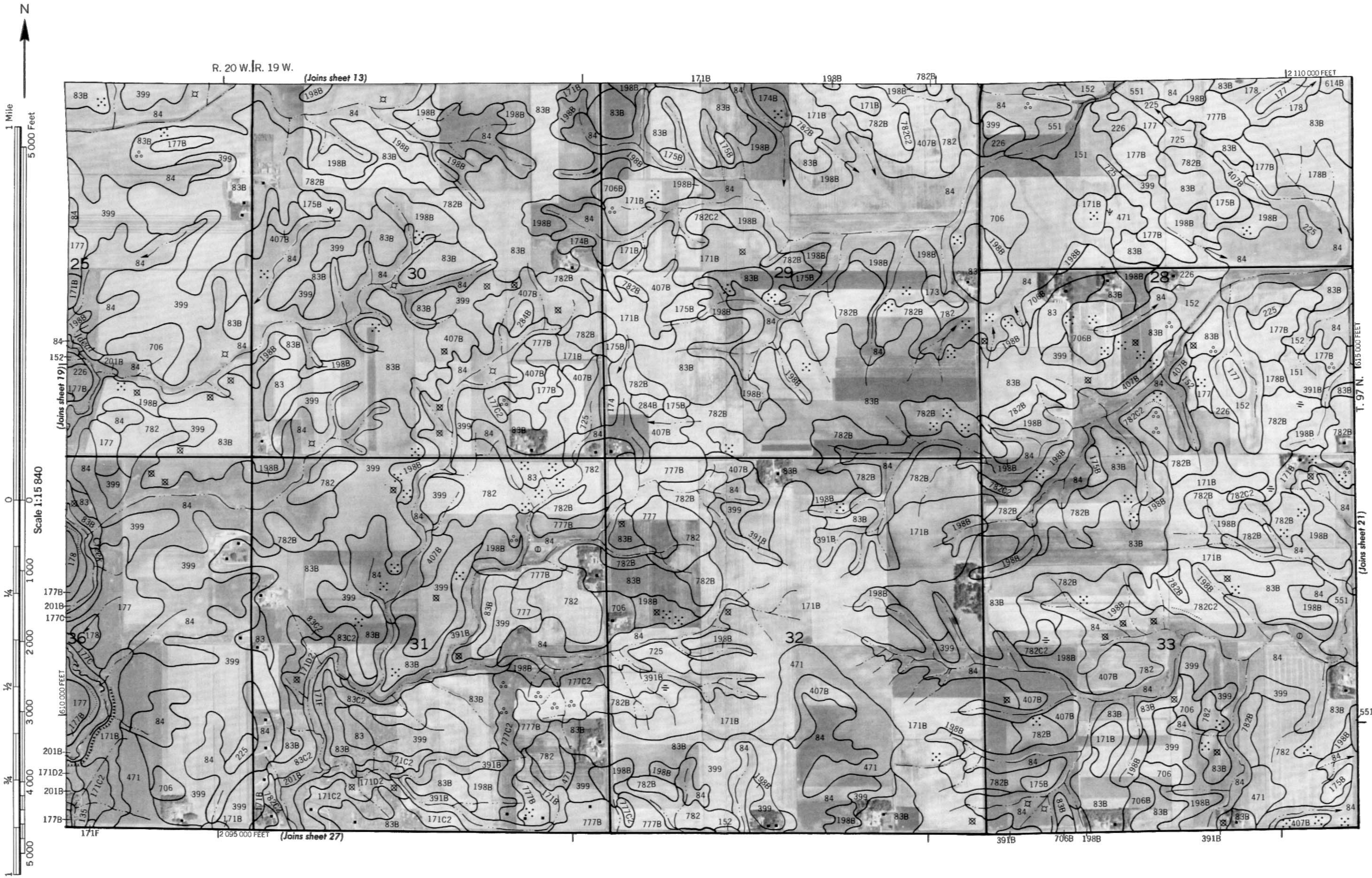

17
N
R. 21 W.
T. 97 N.
2 040 000 FEET
2 055 000 FEET
615 000 FEET
610 000 FEET
(Joins sheet 10)
(Joins sheet 18)
(Joins sheet 24)
(Joins sheet 16)
Calmus
Creek
AIRPORT
S.L.
35
28
27
26
29
32
33
34
35
1 Mile
5 000 Feet
Scale 1:15 840

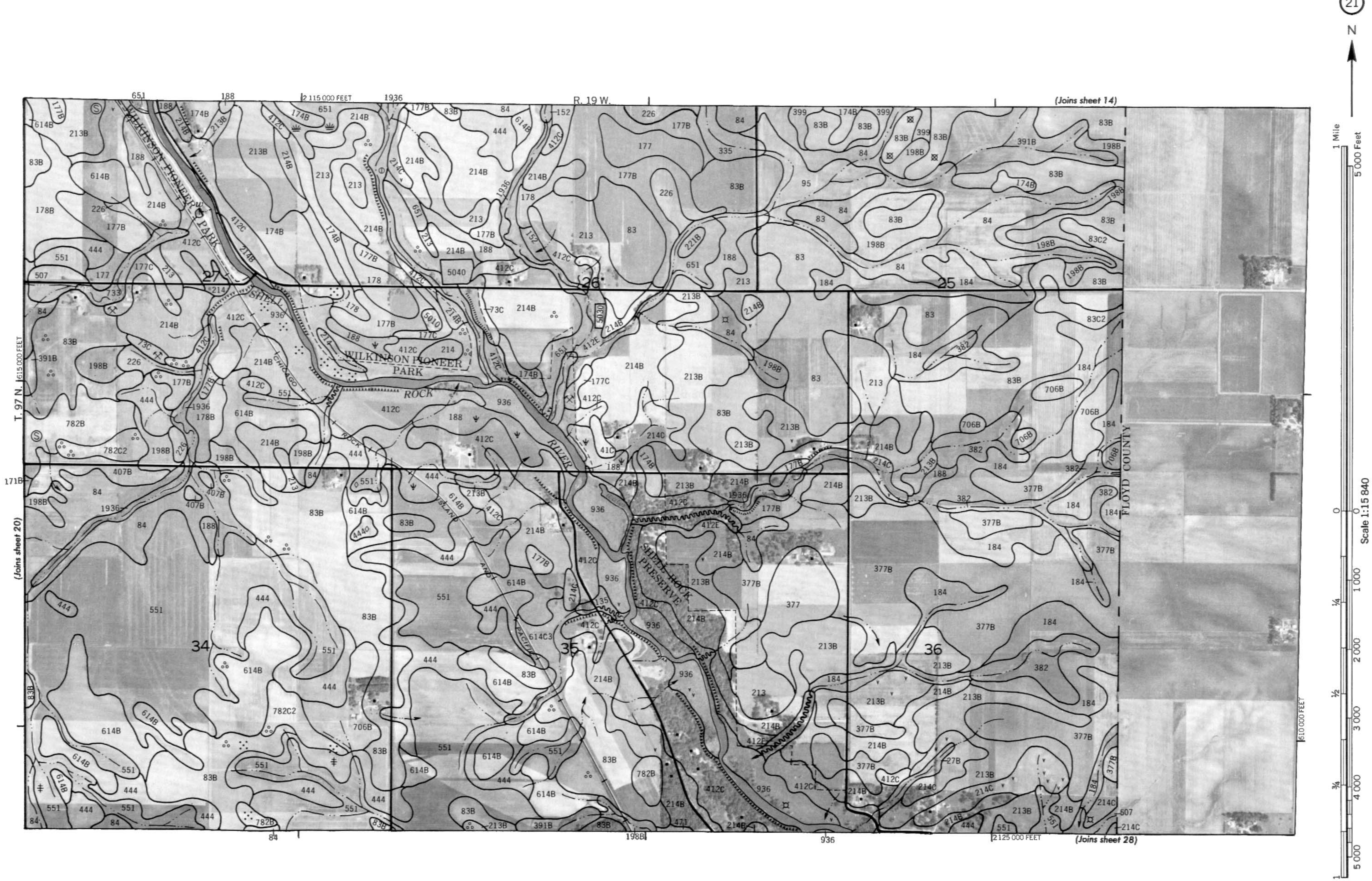
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 18

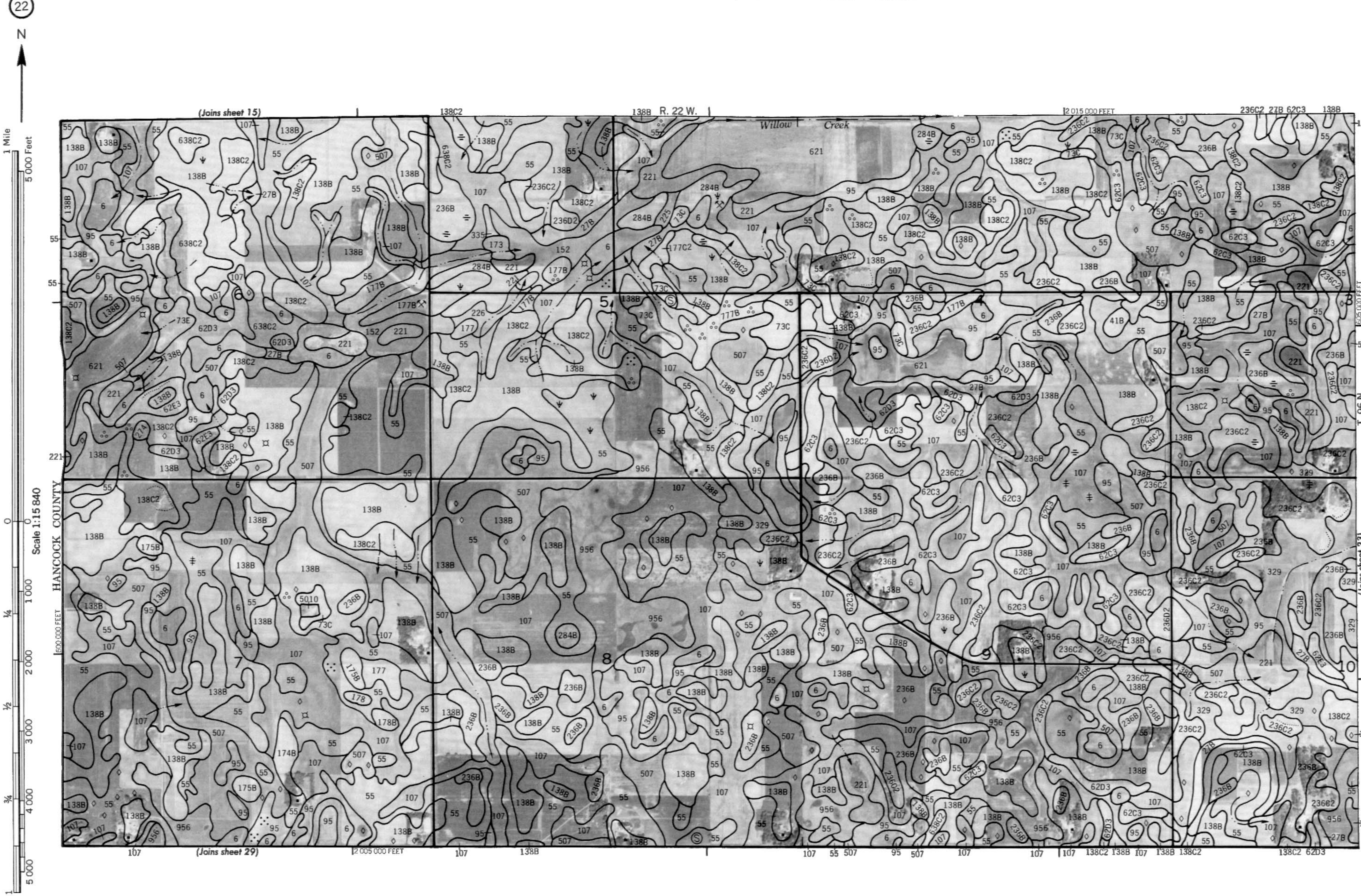


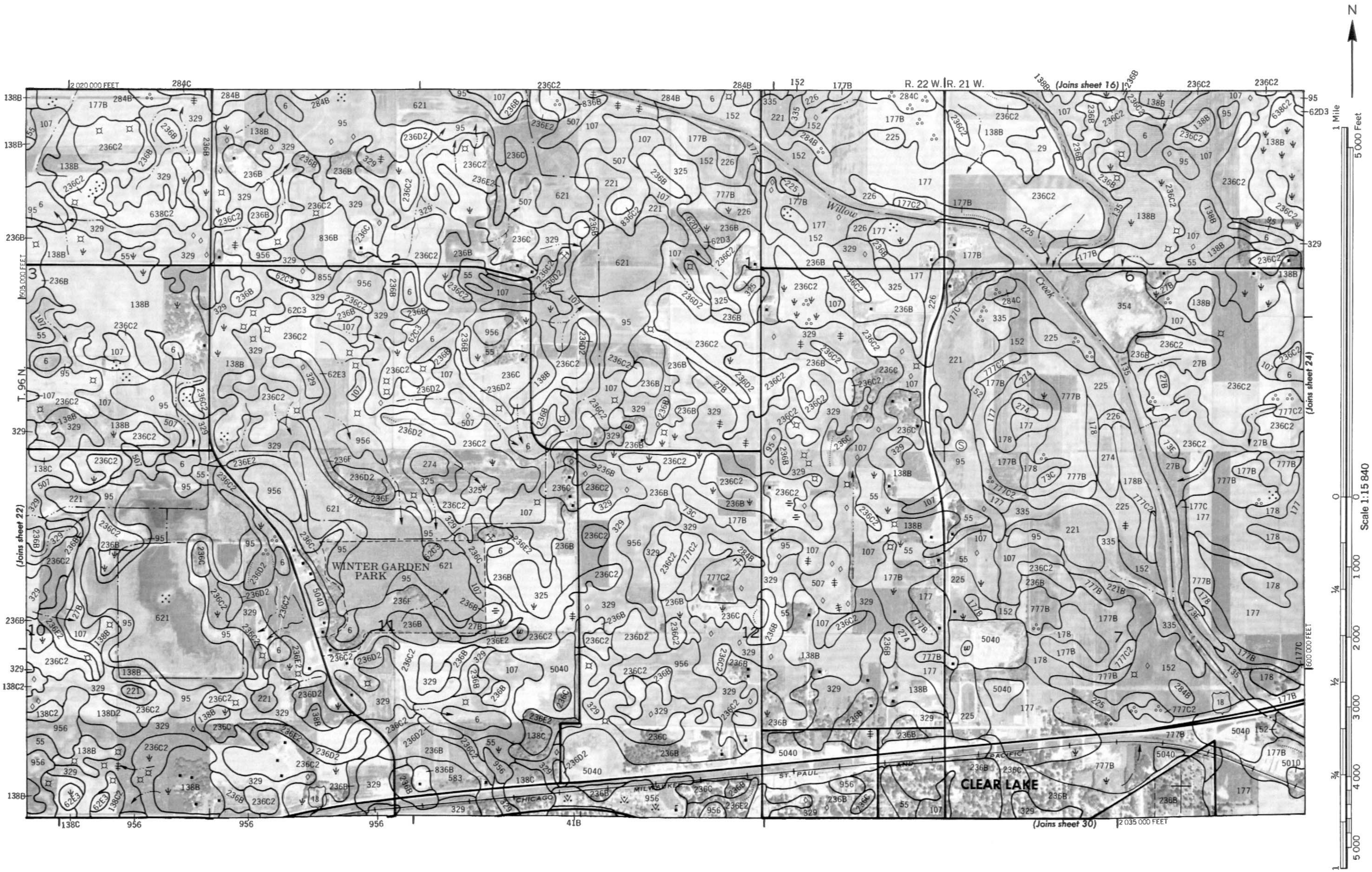

19
N
(Joins sheet 12)
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 26)
R. 20 W.
T. 97 N.
2 075 000 FEET
2 090 000 FEET
615 000 FEET
610 000 FEET
MASON CITY
(county seat)
Winnebago Heights
SPRING PARK
WINNEBAGO RIVER
HANFORD PARK
CEMENT LANDS PARK
Calmus Creek
ROCK ISLAND
CHICAGO AND NORTH WESTERN
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
water
1 Mile
5 000 Feet
Scale 1:15 840
1 000
2 000
3 000
4 000
5 000

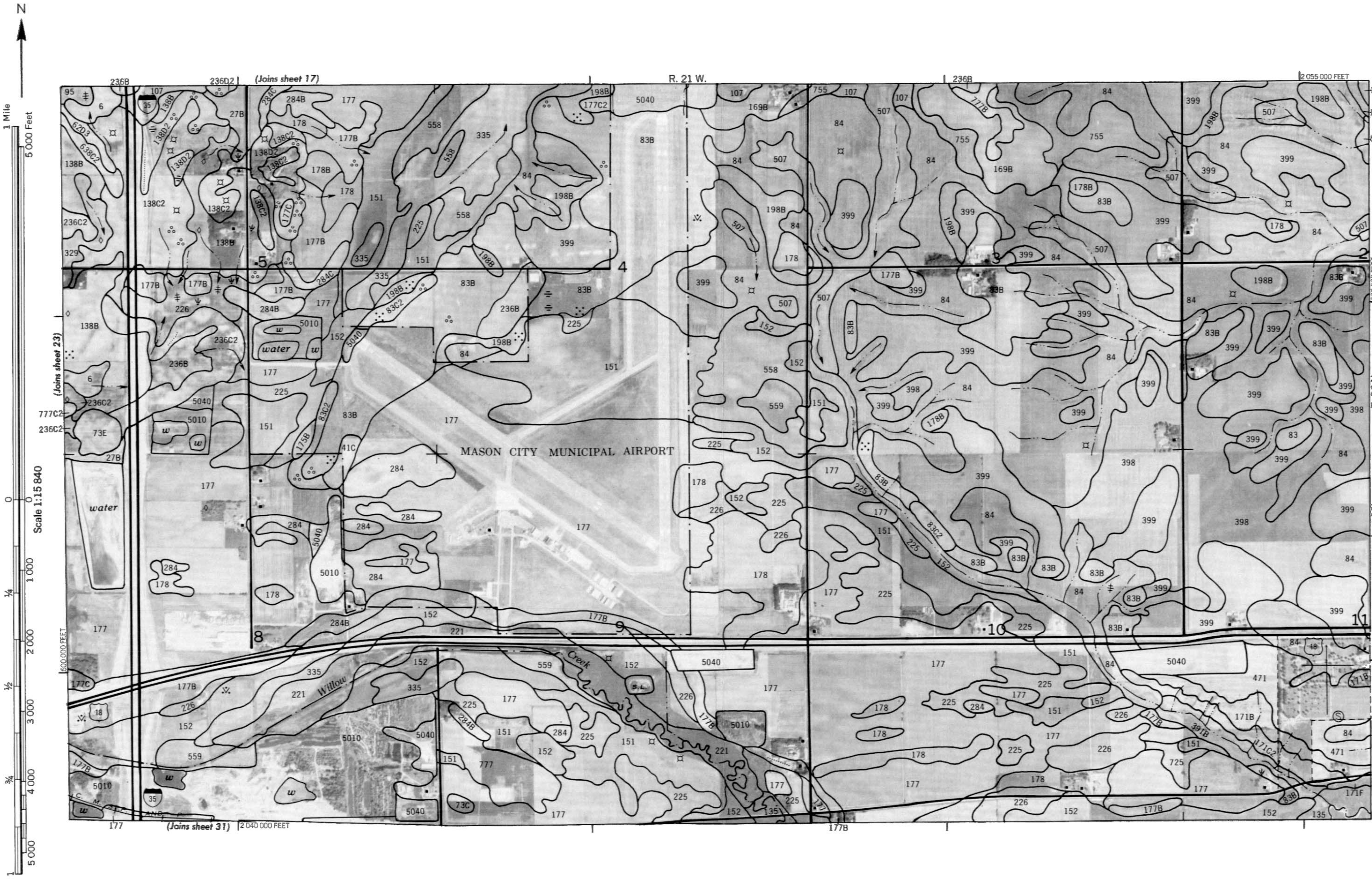
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 20

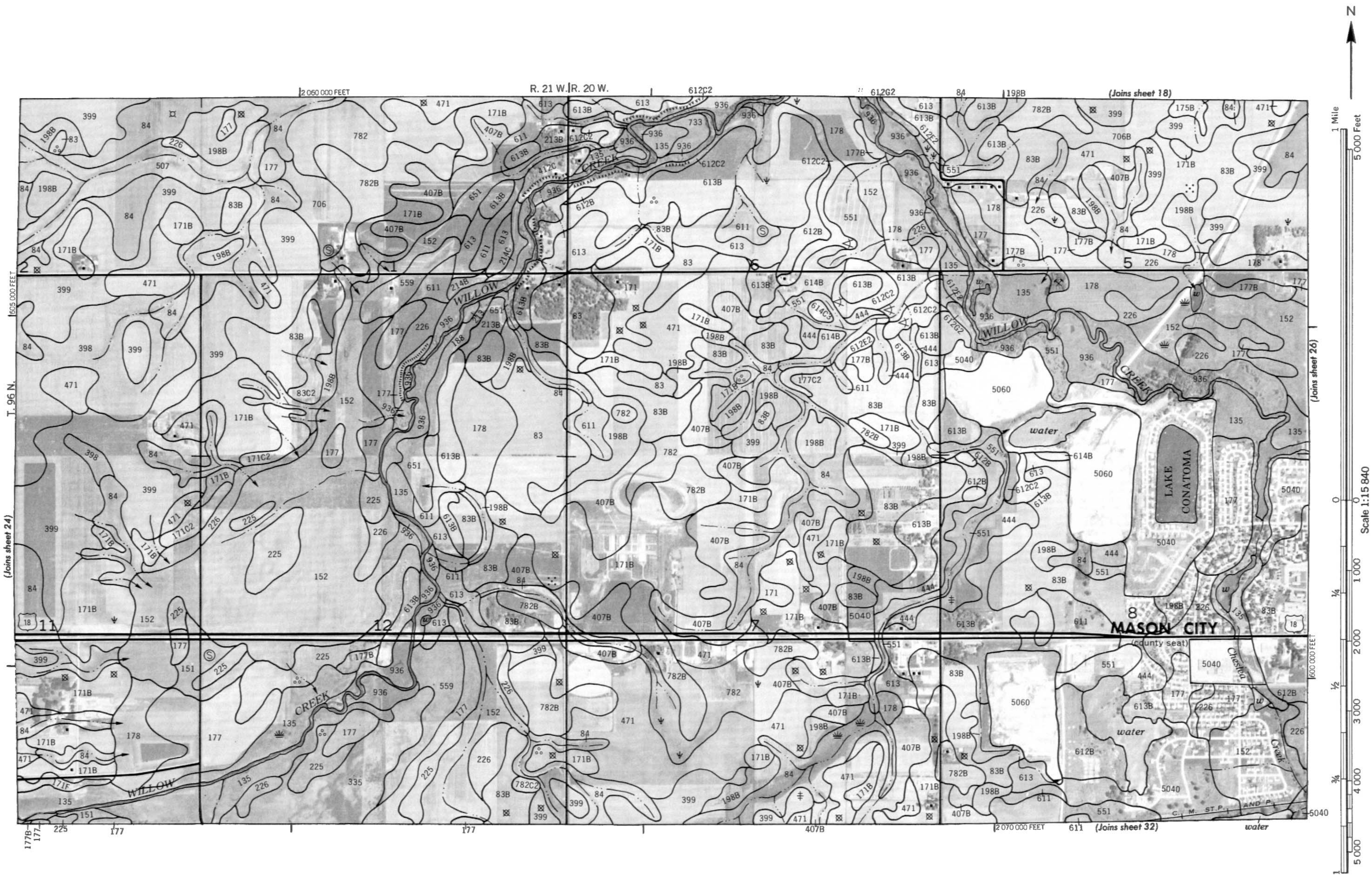


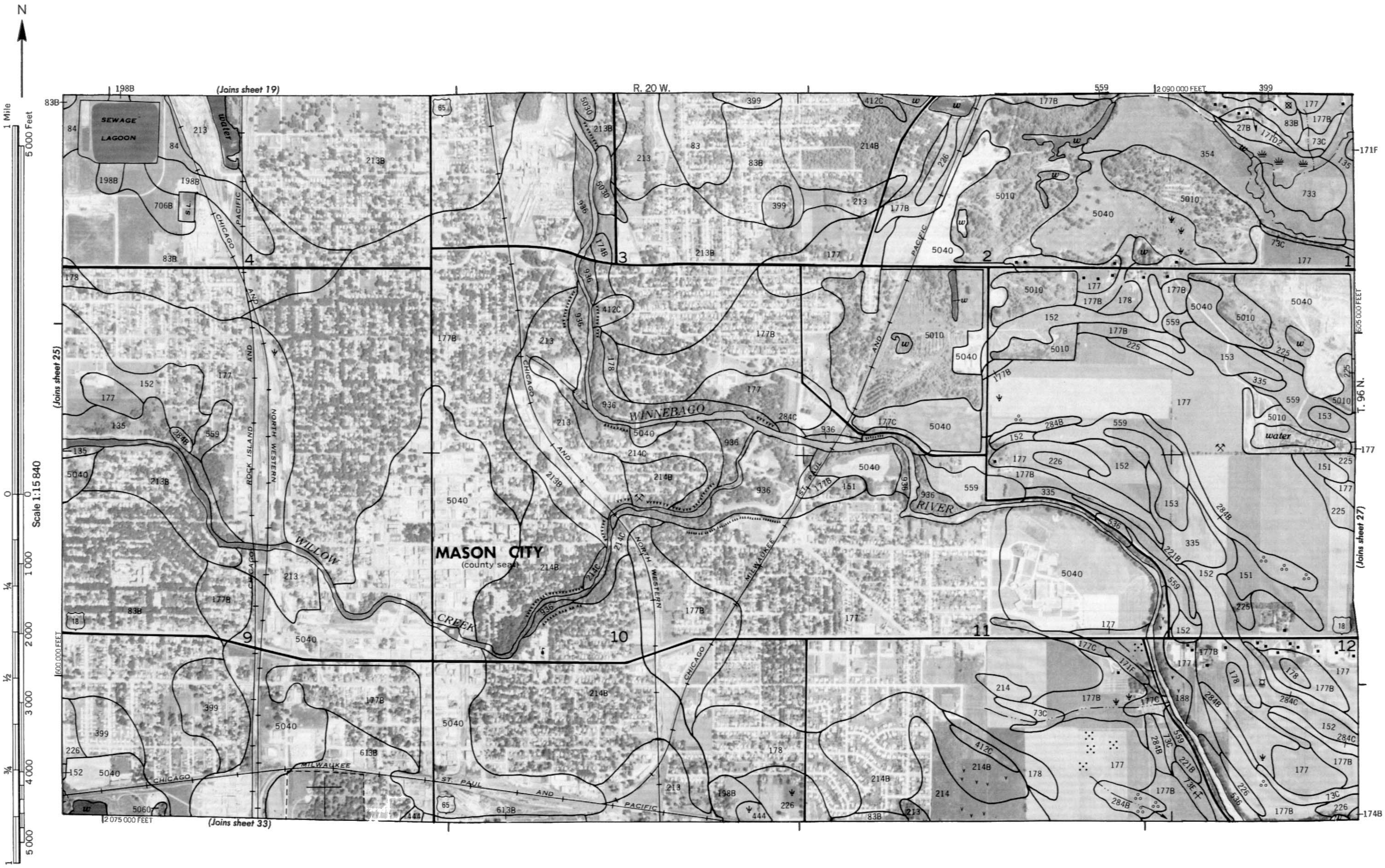

21
N
(Joins sheet 14)
R. 19 W.
2 115 000 FEET
T. 97 N.
615 000 FEET
(Joins sheet 20)
(Joins sheet 28)
2 125 000 FEET
610 000 FEET
WILKINSON PIONEER PARK
SHELL ROCK RIVER
CHICAGO ROCK ISLAND AND PACIFIC
SHELL ROCK PRESERVE
FLOYD COUNTY
27
26
25
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000

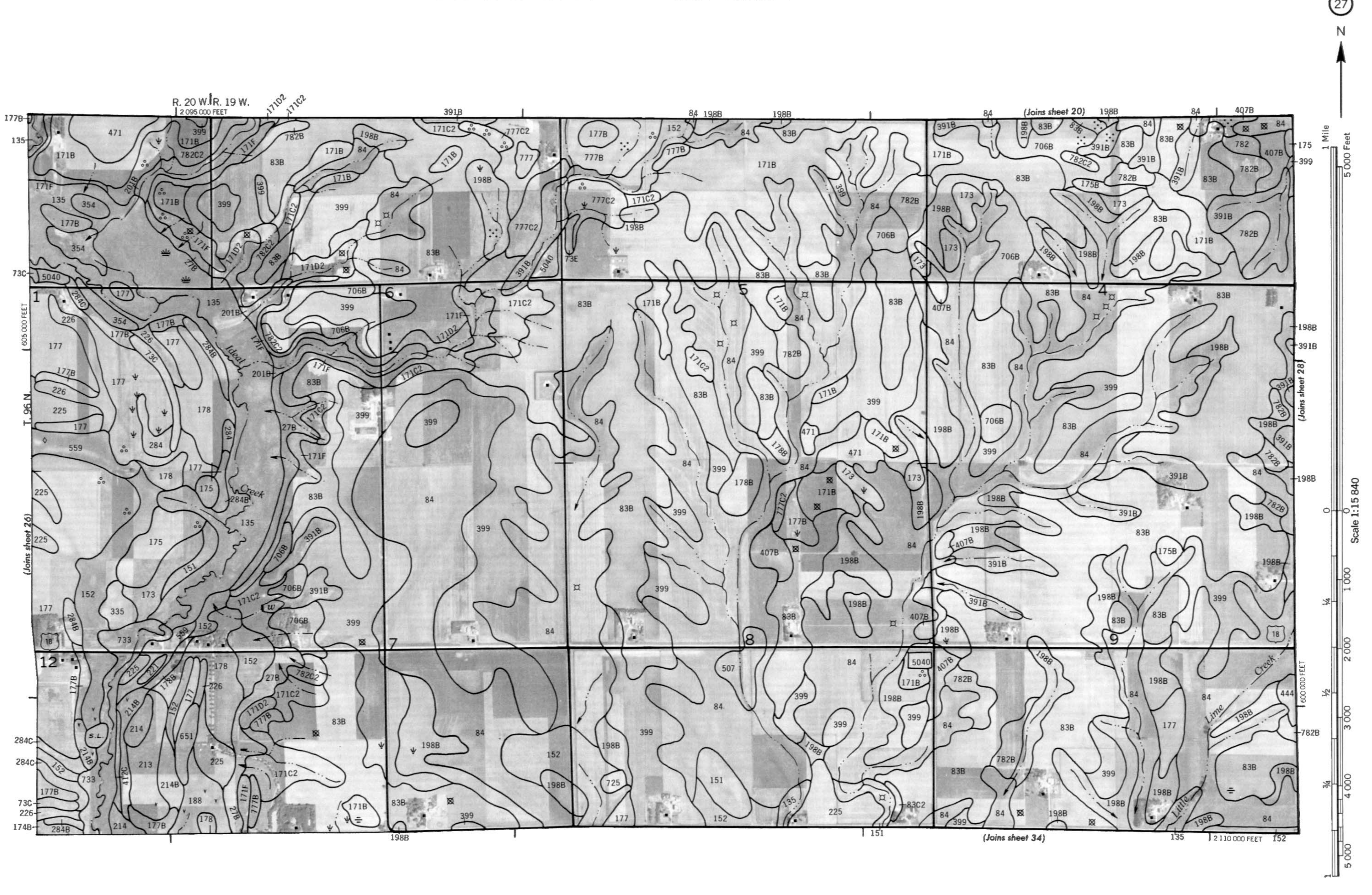

22
N
(Joins sheet 15)
R. 22 W.
Willow Creek
2 015 000 FEET
605 000 FEET
T. 96 N.
(Joins sheet 23)
HANCOCK COUNTY
600 000 FEET
(Joins sheet 29)
2 005 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840


N
2 020 000 FEET
R. 22 W.
R. 21 W.
(Joins sheet 16)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 30)
T. 96 N.
605 000 FEET
600 000 FEET
2 035 000 FEET
Willow
Creek
WINTER GARDEN PARK
CLEAR LAKE
CHICAGO
MILWAUKEE
ST. PAUL
AND
PACIFIC
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1
1 000
2 000
3 000
4 000
5 000

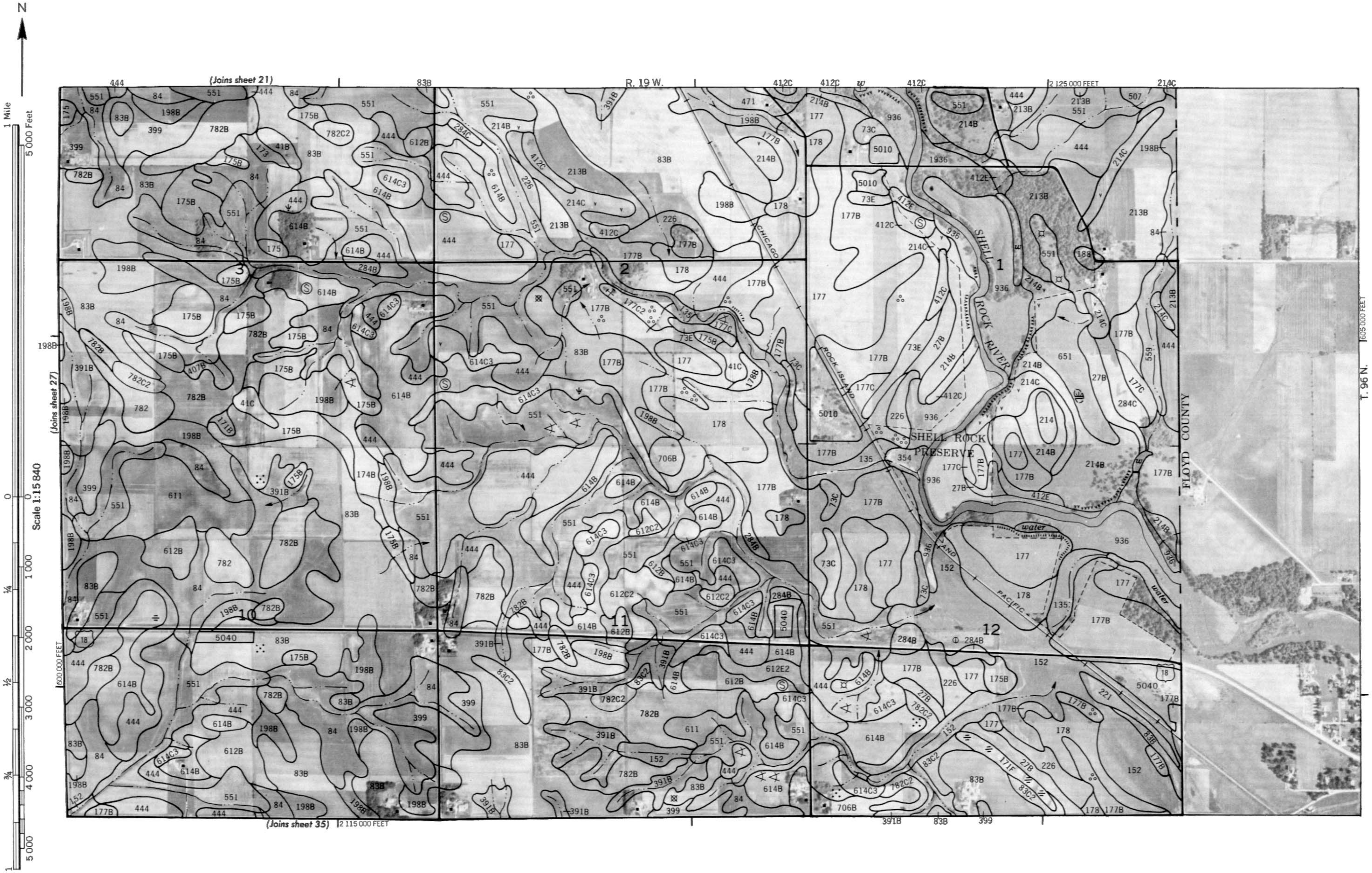

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 17)
R. 21 W.
2 055 000 FEET
(Joins sheet 23)
605 000 FEET
T. 96 N.
(Joins sheet 25)
MASON CITY MUNICIPAL AIRPORT
water
Willow
Creek
600 000 FEET
(Joins sheet 31)
2 040 000 FEET


N
R. 21 W.
R. 20 W.
(Joins sheet 18)
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 32)
T. 96 N.
2 060 000 FEET
2 070 000 FEET
605 000 FEET
600 000 FEET
WILLOW CREEK
CREEK
WILLOW
LAKE CONATOMA
MASON CITY
(county seat)
Chesford Creek
water
C. M. ST. P. AND P.
1 Mile
5 000 Feet
Scale 1:15 840

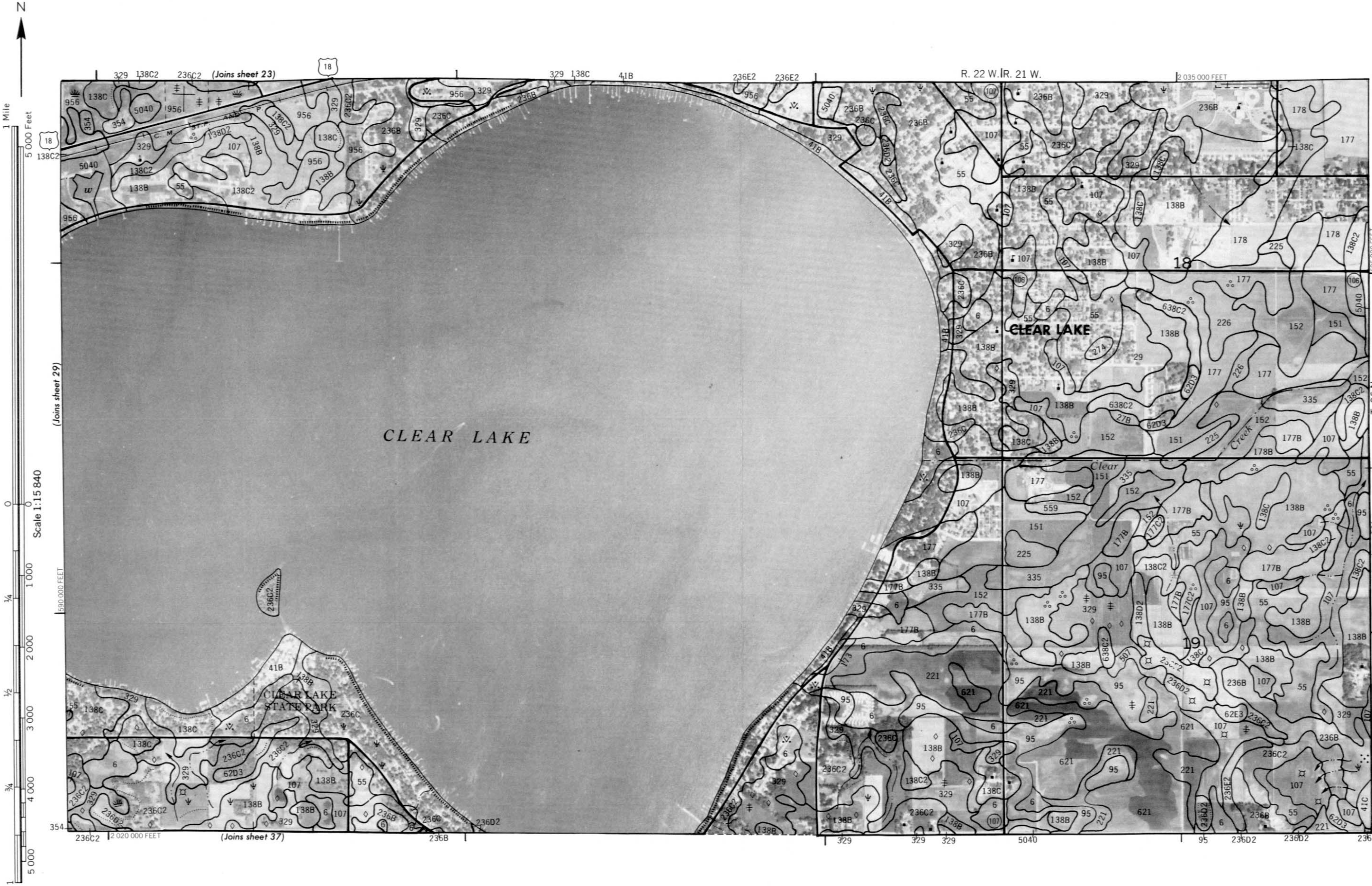

26
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 19)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 33)
R. 20 W.
T. 96 N.
2 090 000 FEET
2 075 000 FEET
605 000 FEET
600 000 FEET
SEWAGE LAGOON
MASON CITY
(county seat)
WILLOW CREEK
WINNEBAGO RIVER
CHICAGO ROCK ISLAND AND PACIFIC
CHICAGO AND NORTH WESTERN
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
water

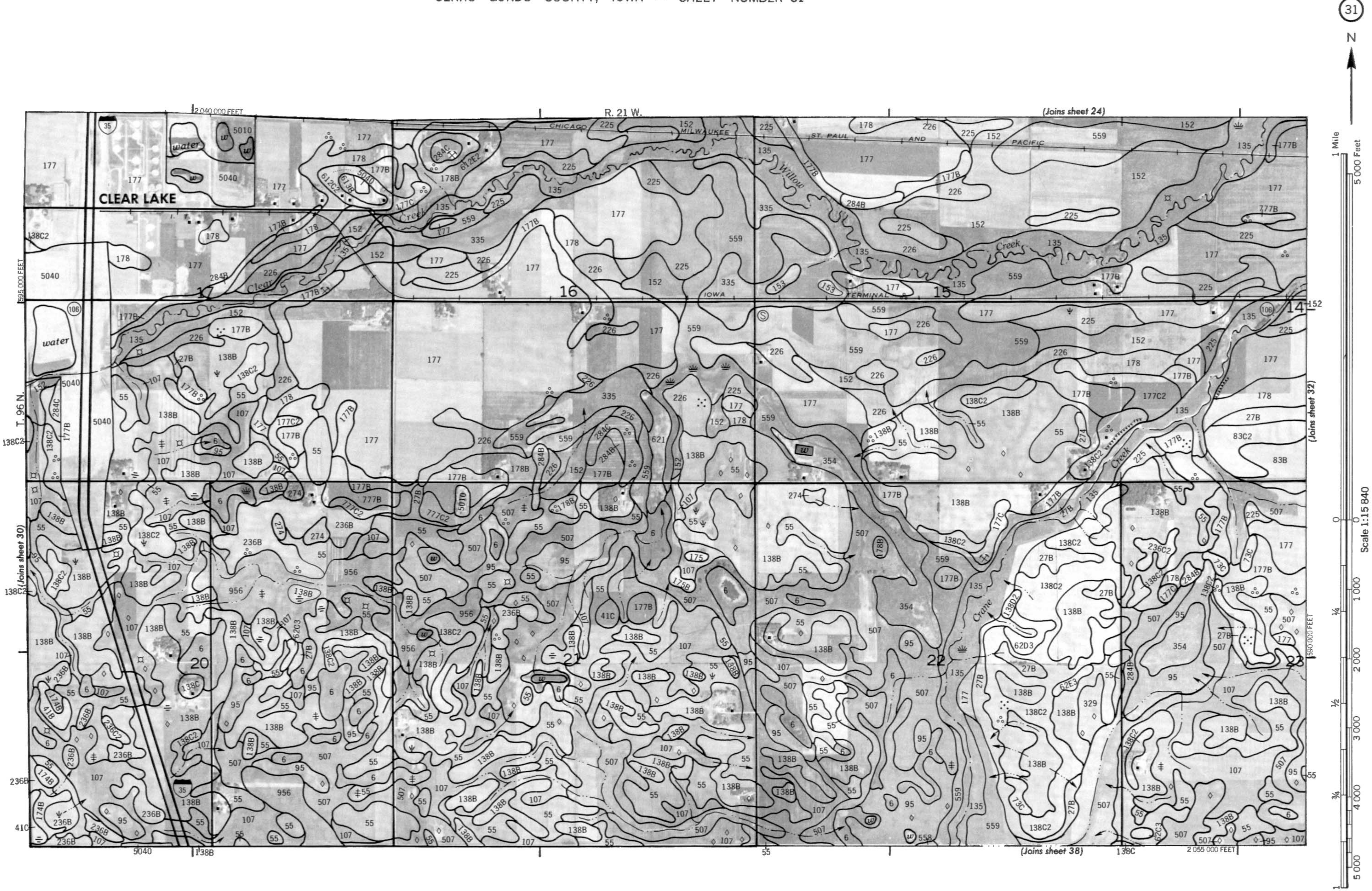

27
N
R. 20 W. R. 19 W.
2 095 000 FEET
605 000 FEET
600 000 FEET
2 110 000 FEET
T. 96 N.
(Joins sheet 20)
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 34)
Ideal Creek
Little Lime Creek
1 Mile
5 000 Feet
Scale 1:15 840

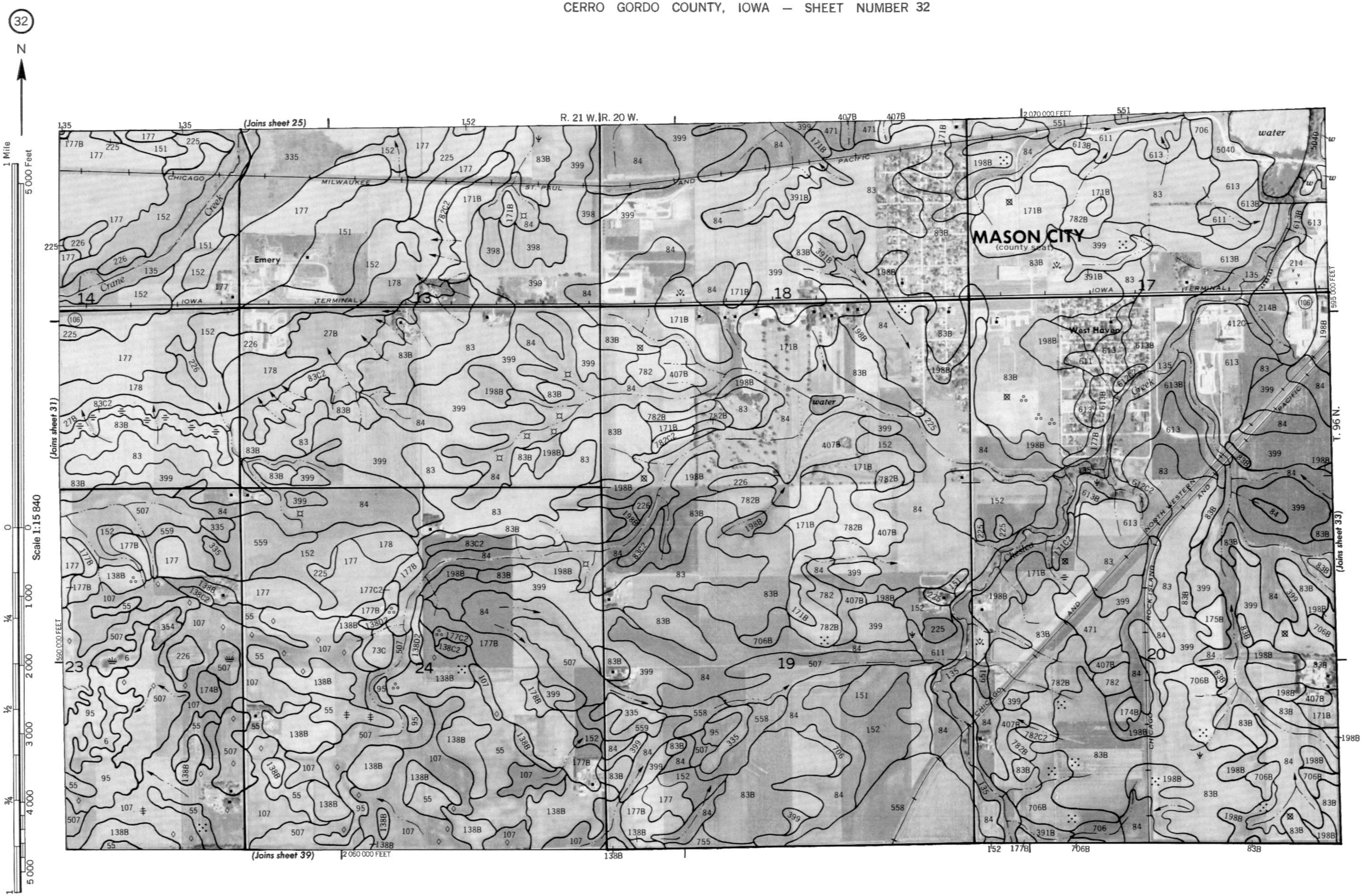
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 28

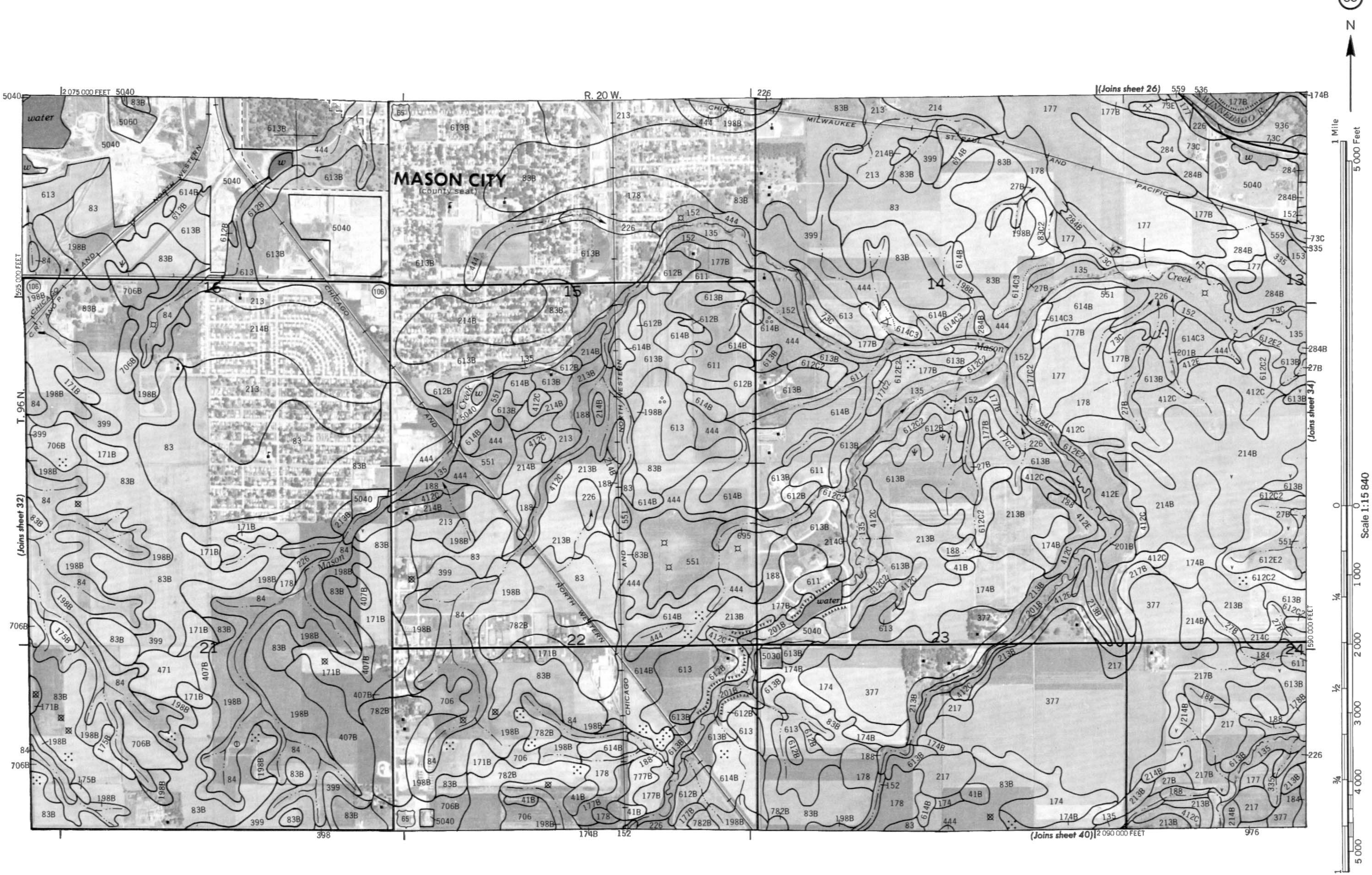



29
N
R. 22 W.
(Joins sheet 22)
(Joins sheet 30)
(Joins sheet 36)
T. 96 N.
HANCOCK COUNTY
Ventura
VENTURA MARSH
CLEAR LAKE
McINTOSH WOODS
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
2 005 000 FEET
2 015 000 FEET
595 000 FEET
590 000 FEET
18
17
16
15
22
1 Mile
5 000 Feet
Scale 1:15 840

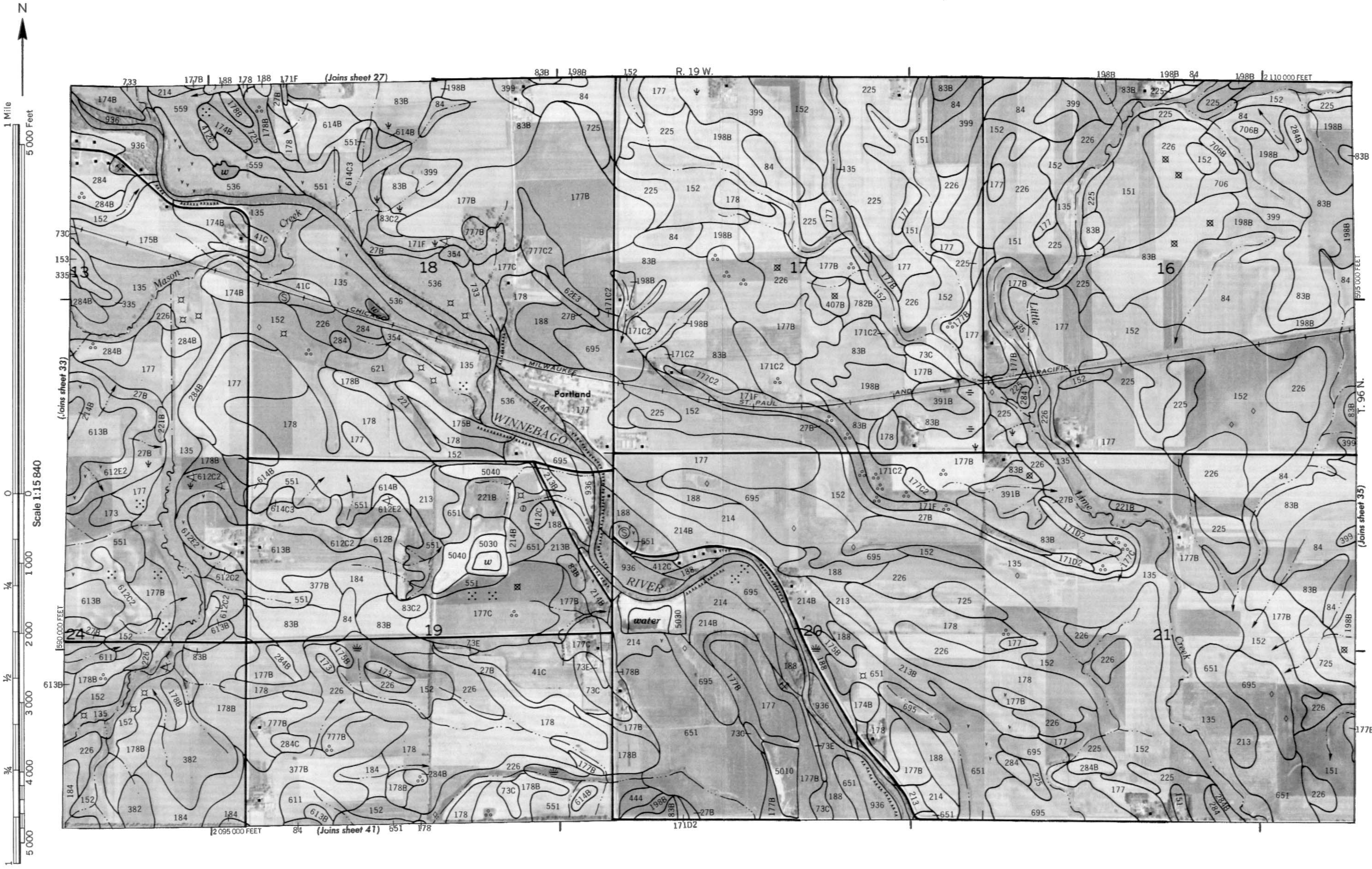

N
CLEAR LAKE
CLEAR LAKE
CLEAR LAKE STATE PARK
Clear Creek
(Joins sheet 23)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 37)
R. 22 W. R. 21 W.
T. 96 N.
2 035 000 FEET
2 020 000 FEET
590 000 FEET
595 000 FEET
18
19
Scale 1:15 840
1 Mile
5 000 Feet


31
N
(Joins sheet 24)
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 30)
R. 21 W.
T. 96 N.
CLEAR LAKE
2 040 000 FEET
595 000 FEET
590 000 FEET
2 055 000 FEET
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
IOWA TERMINAL
Clear Creek
Willow Creek
Crane Creek
water
16
17
15
14
20
21
22
23
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1

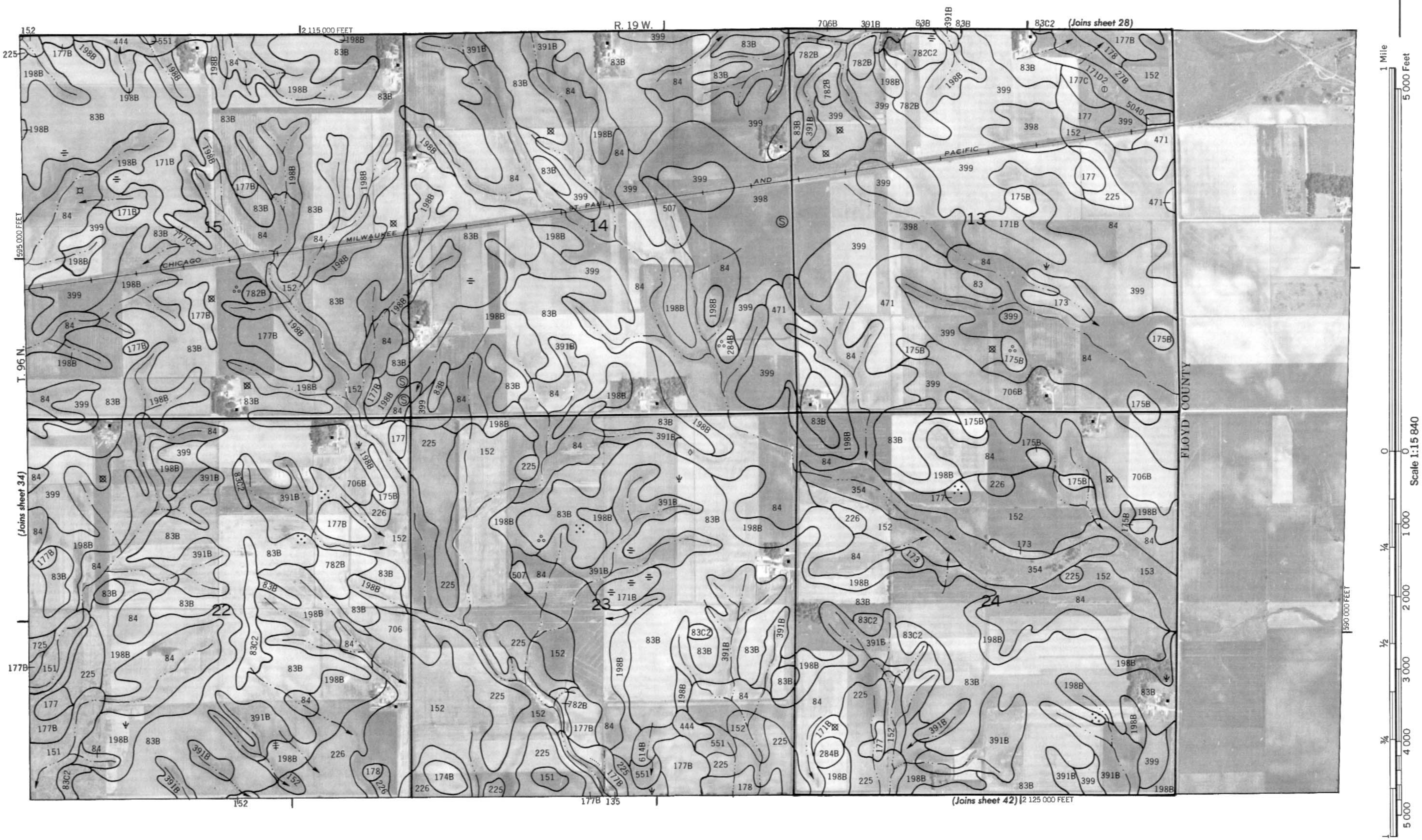

32
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 25)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 39)
R. 21 W. | R. 20 W.
T. 96 N.
MASON CITY
(county seat)
West Haven
Emery
2 070 000 FEET
2 060 000 FEET
595 000 FEET
590 000 FEET
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
IOWA TERMINAL
CHICAGO AND NORTH WESTERN
CHICAGO ROCK ISLAND AND PACIFIC
Crane Creek
Chelsea Creek
water

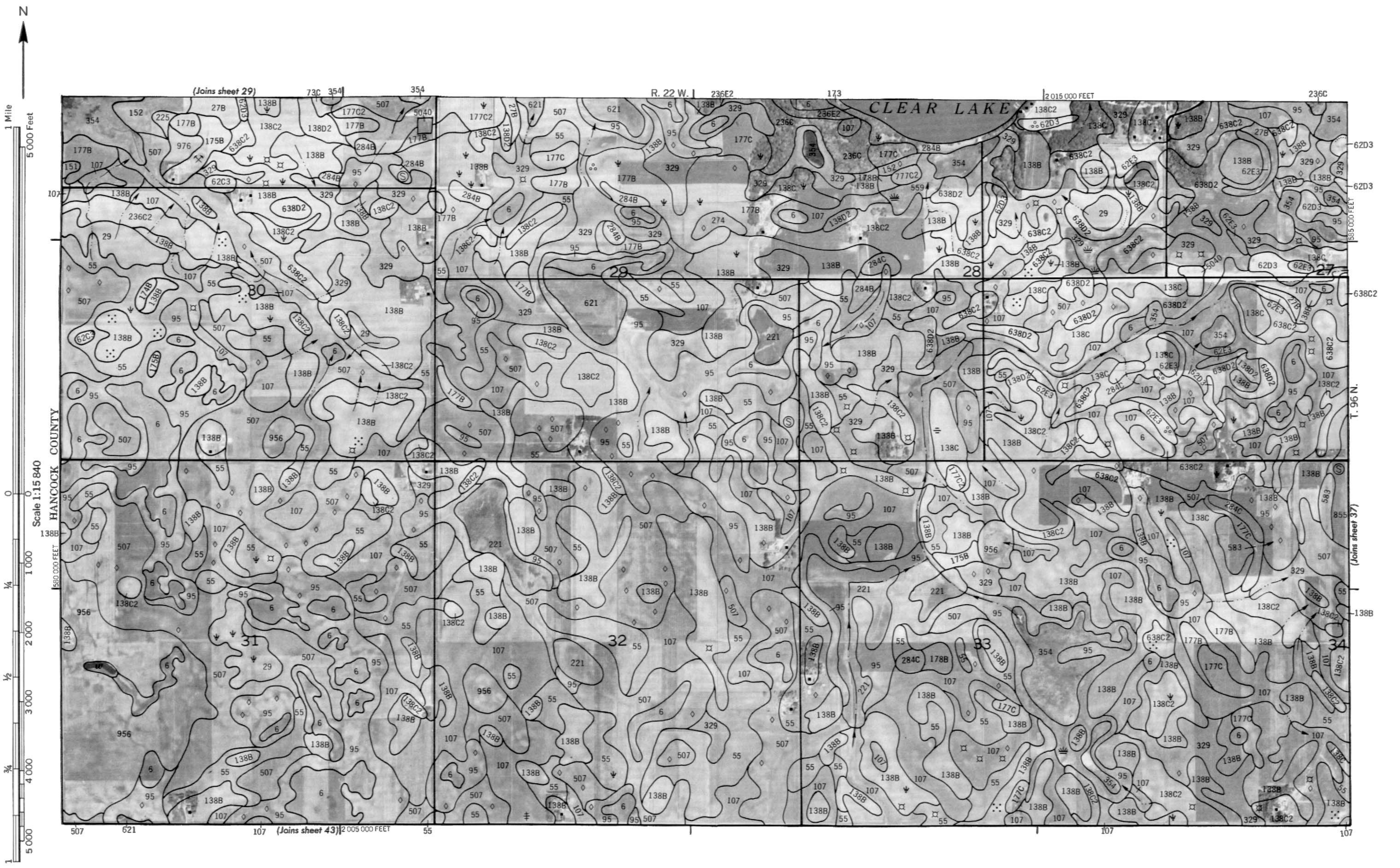

33
N
MASON CITY
(county seat)
R. 20 W.
T. 96 N.
(Joins sheet 26)
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 40)
2 075 000 FEET
2 090 000 FEET
595 000 FEET
590 000 FEET
CHICAGO AND NORTH WESTERN
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
Mason Creek
WINNEBAGO R.
water
1 Mile
5 000 Feet
Scale 1:15 840

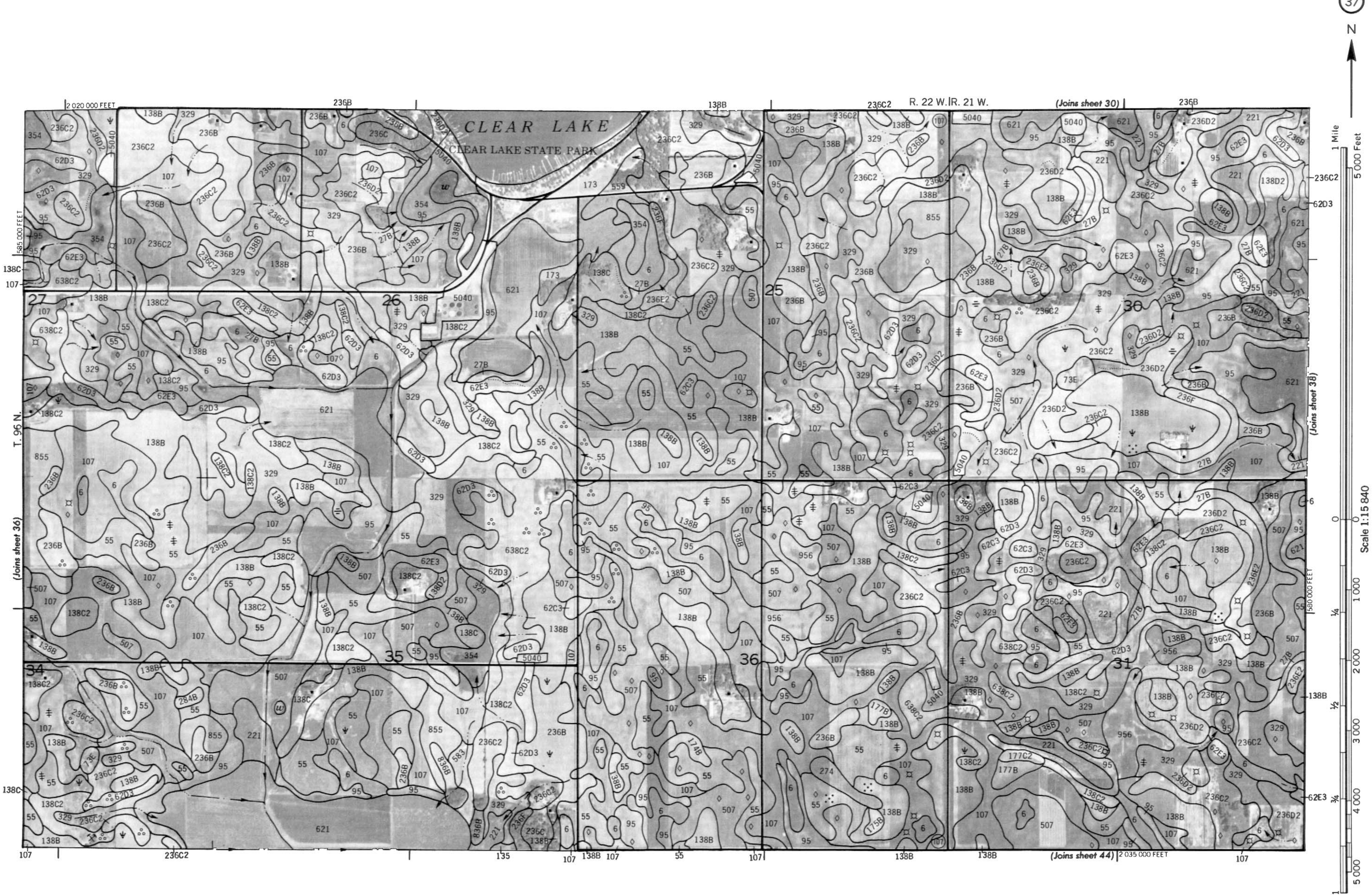
34

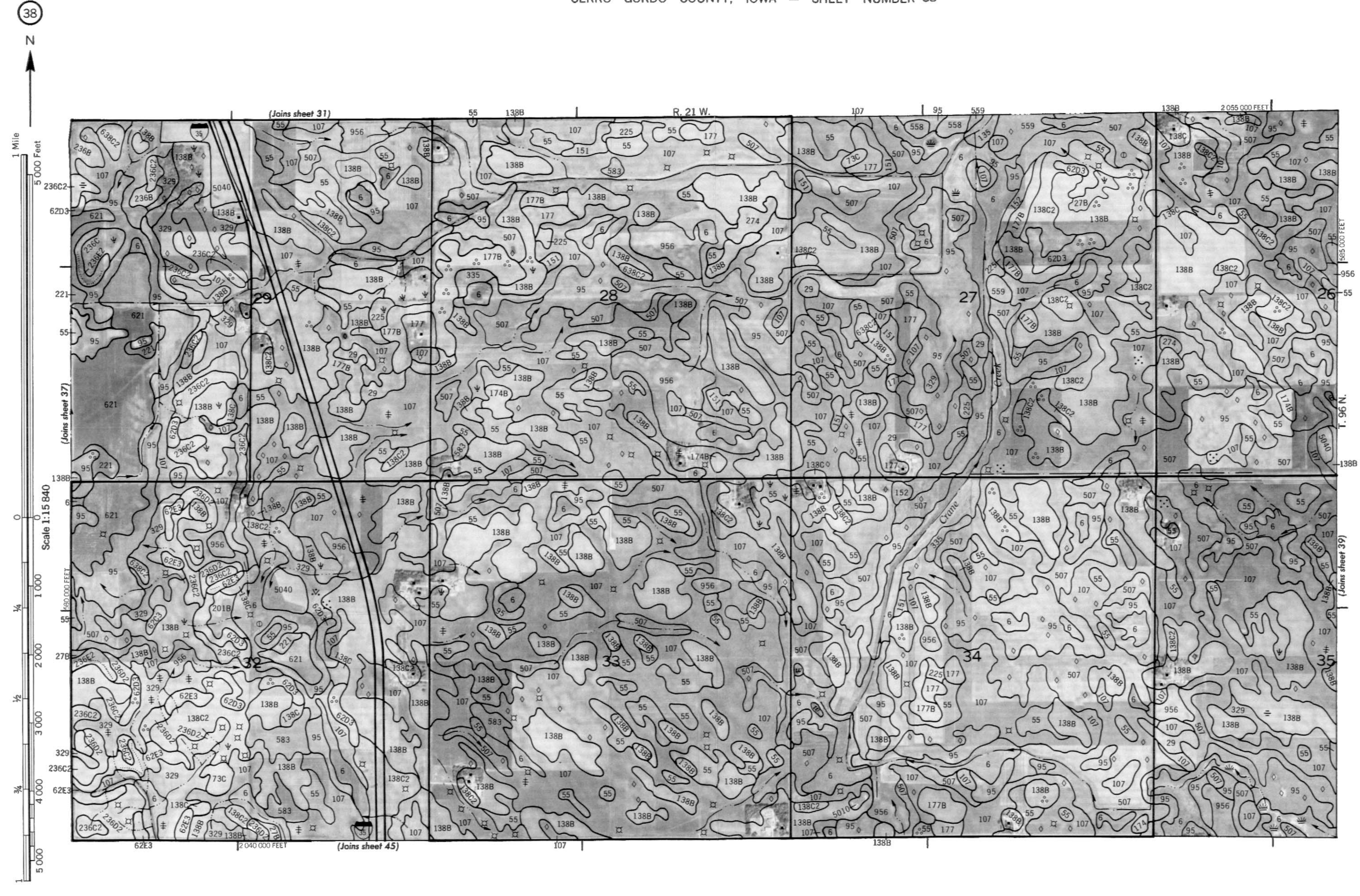

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 41)
R. 19 W.
T. 96 N.
2 110 000 FEET
2 095 000 FEET
595 000 FEET
590 000 FEET
Portland
WINNEBAGO
RIVER
Mason
Creek
Little
Lime
Creek
CHICAGO
MILWAUKEE
ST. PAUL
AND
PACIFIC
water
13
16
17
18
19
20
21
24

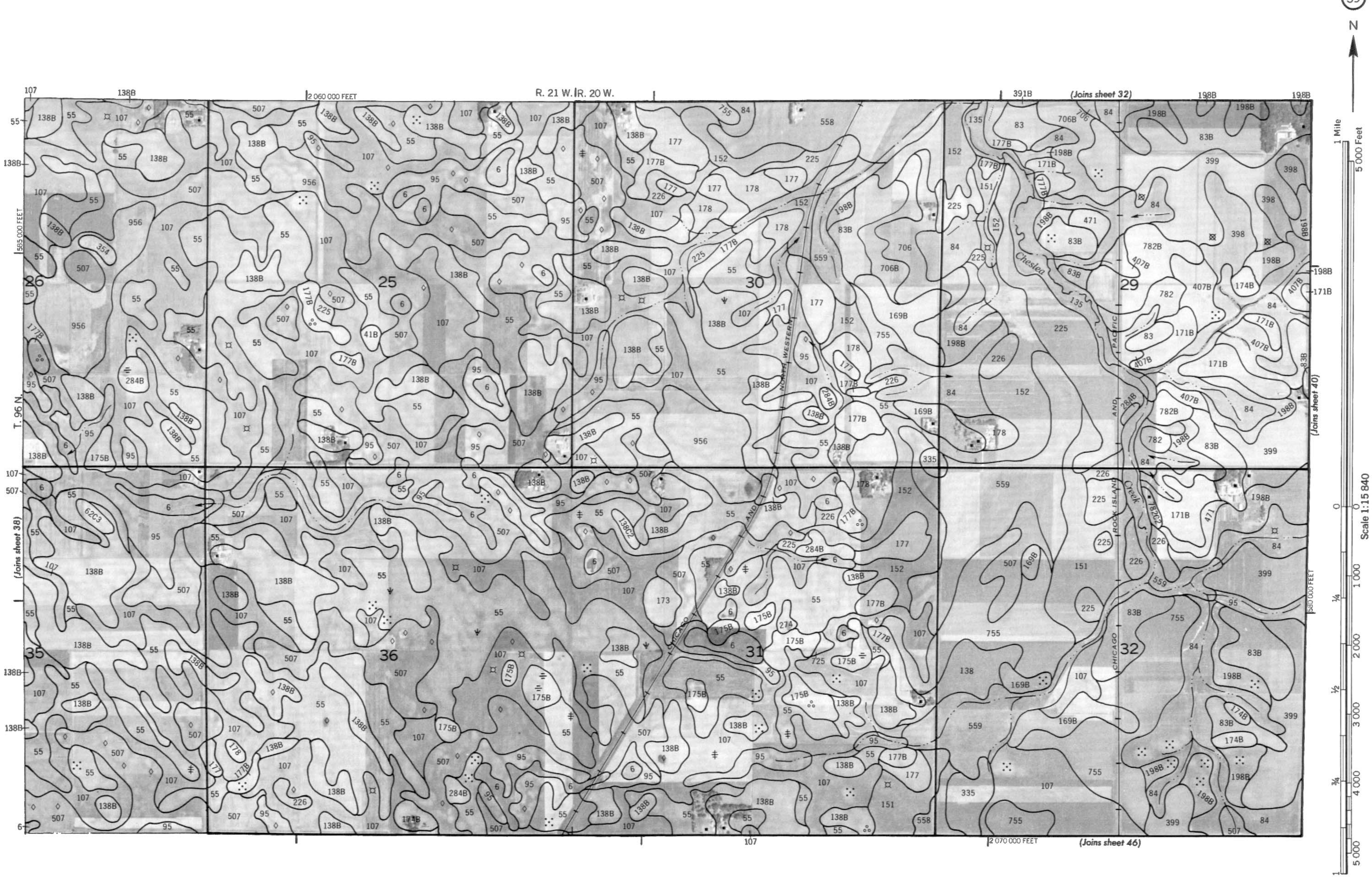
N

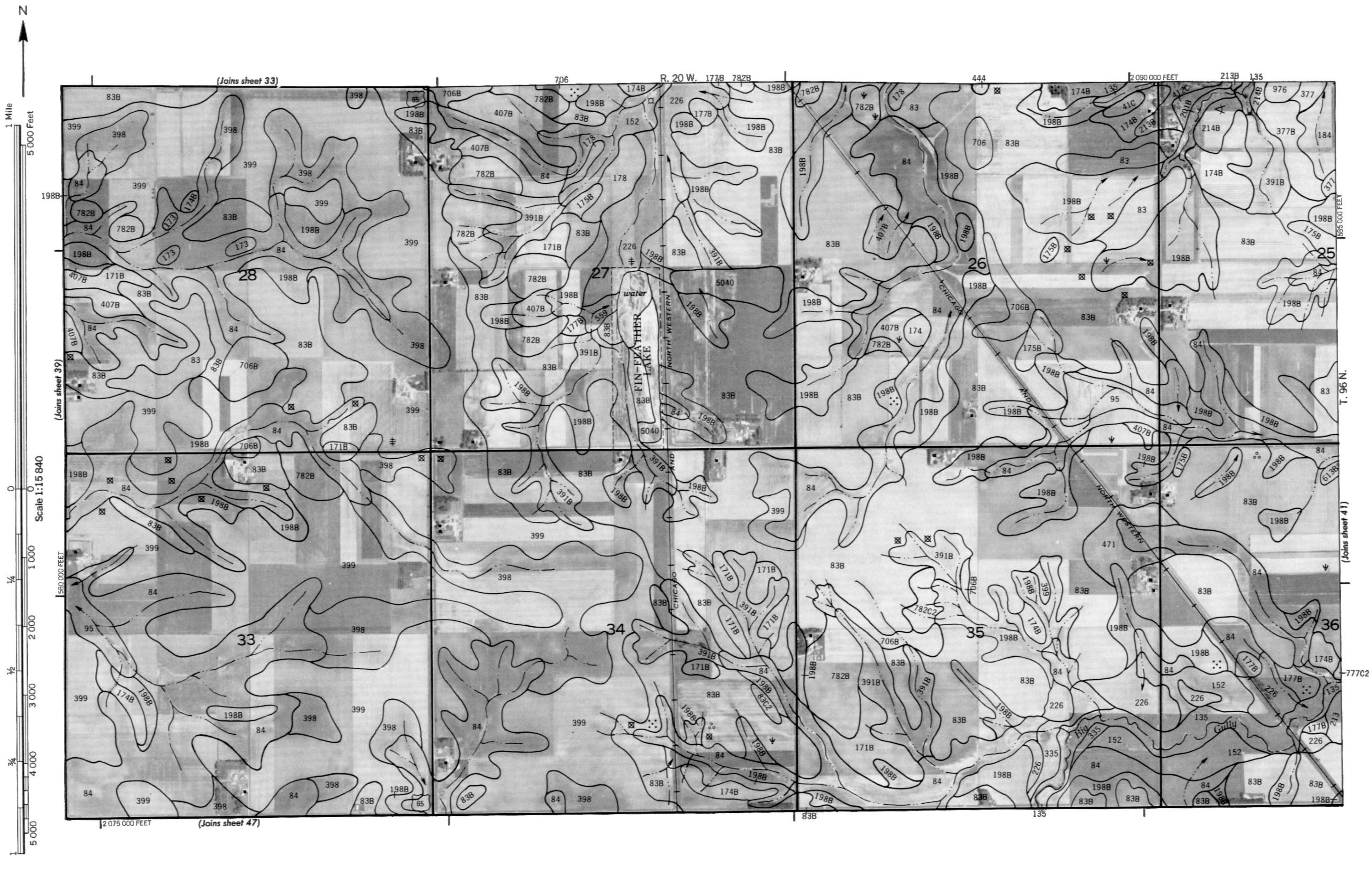

(Joins sheet 28)
R. 19 W.
2 115 000 FEET
595 000 FEET
T. 96 N.
(Joins sheet 34)
CHICAGO
MILWAUKEE
ST. PAUL
AND
PACIFIC
15
14
13
22
23
24
FLOYD COUNTY
590 000 FEET
(Joins sheet 42)
2 125 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

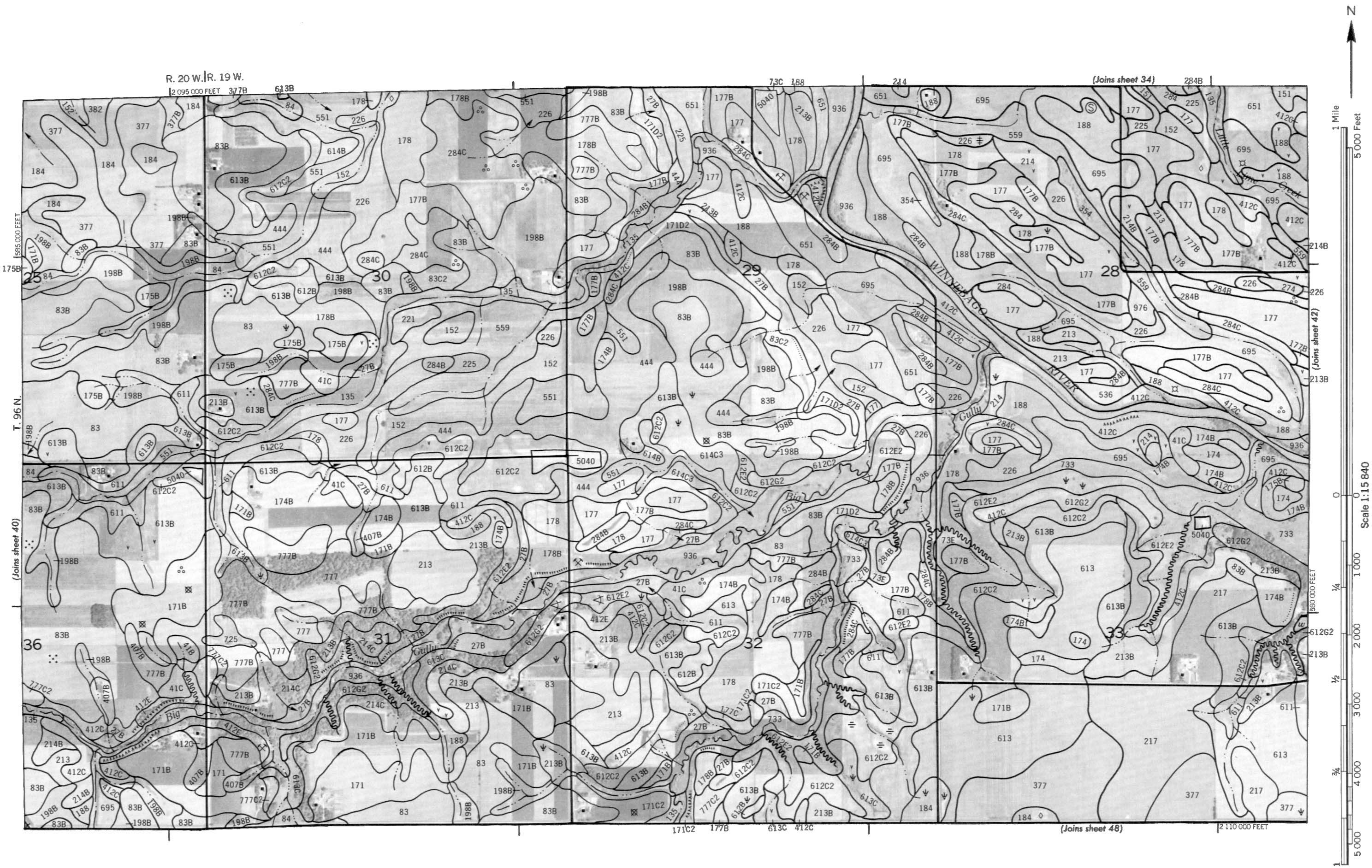

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 29)
R. 22 W.
CLEAR LAKE
2 015 000 FEET
585 000 FEET
T. 96 N.
(Joins sheet 37)
HANCOCK COUNTY
580 000 FEET
(Joins sheet 43)
2 005 000 FEET

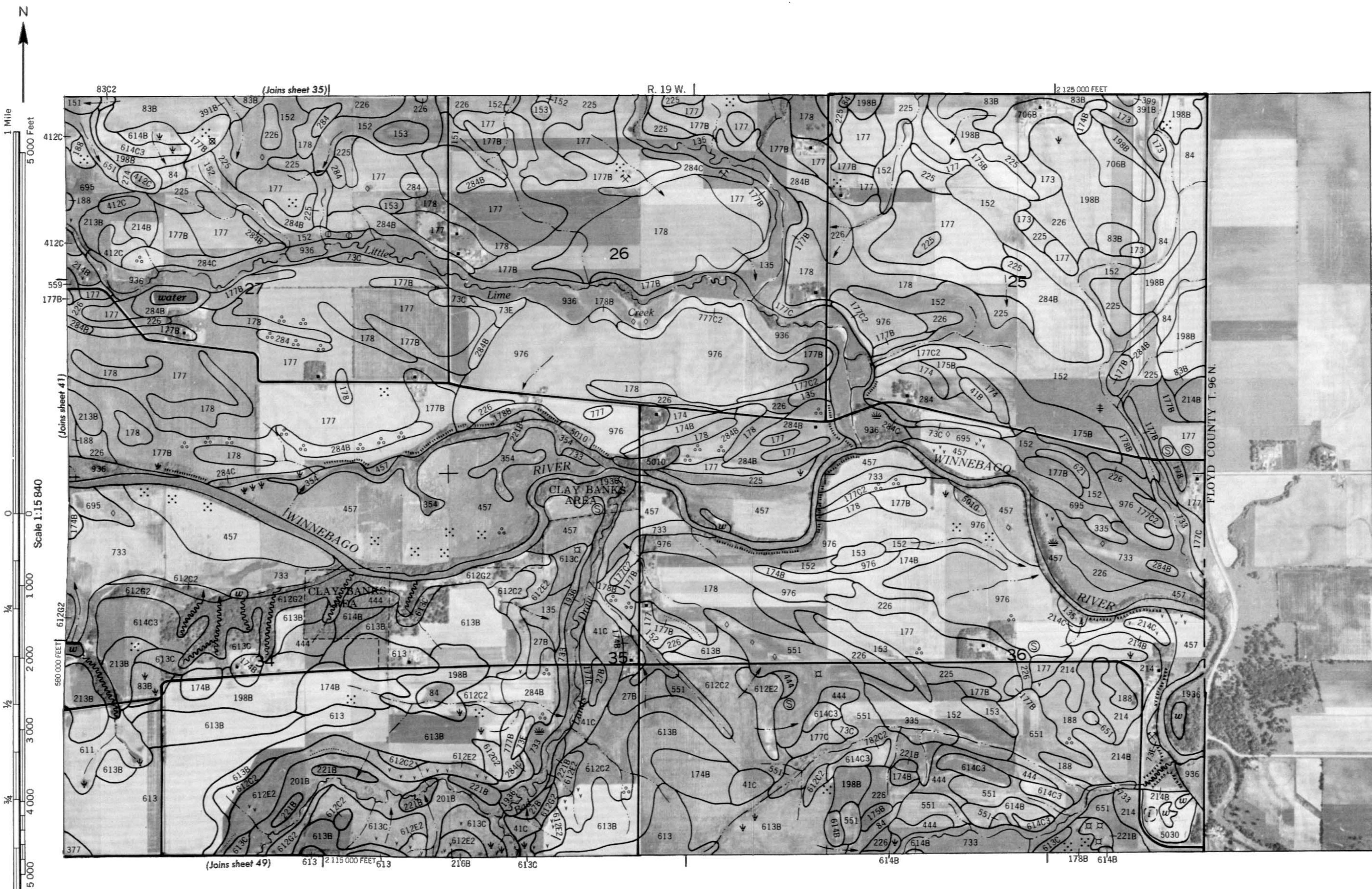

37
N
CLEAR LAKE
CLEAR LAKE STATE PARK
R. 22 W. | R. 21 W.
(Joins sheet 30)
(Joins sheet 38)
(Joins sheet 44)
(Joins sheet 36)
T. 96 N.
2 020 000 FEET
2 035 000 FEET
585 000 FEET
580 000 FEET
27
26
25
30
34
35
36
31
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

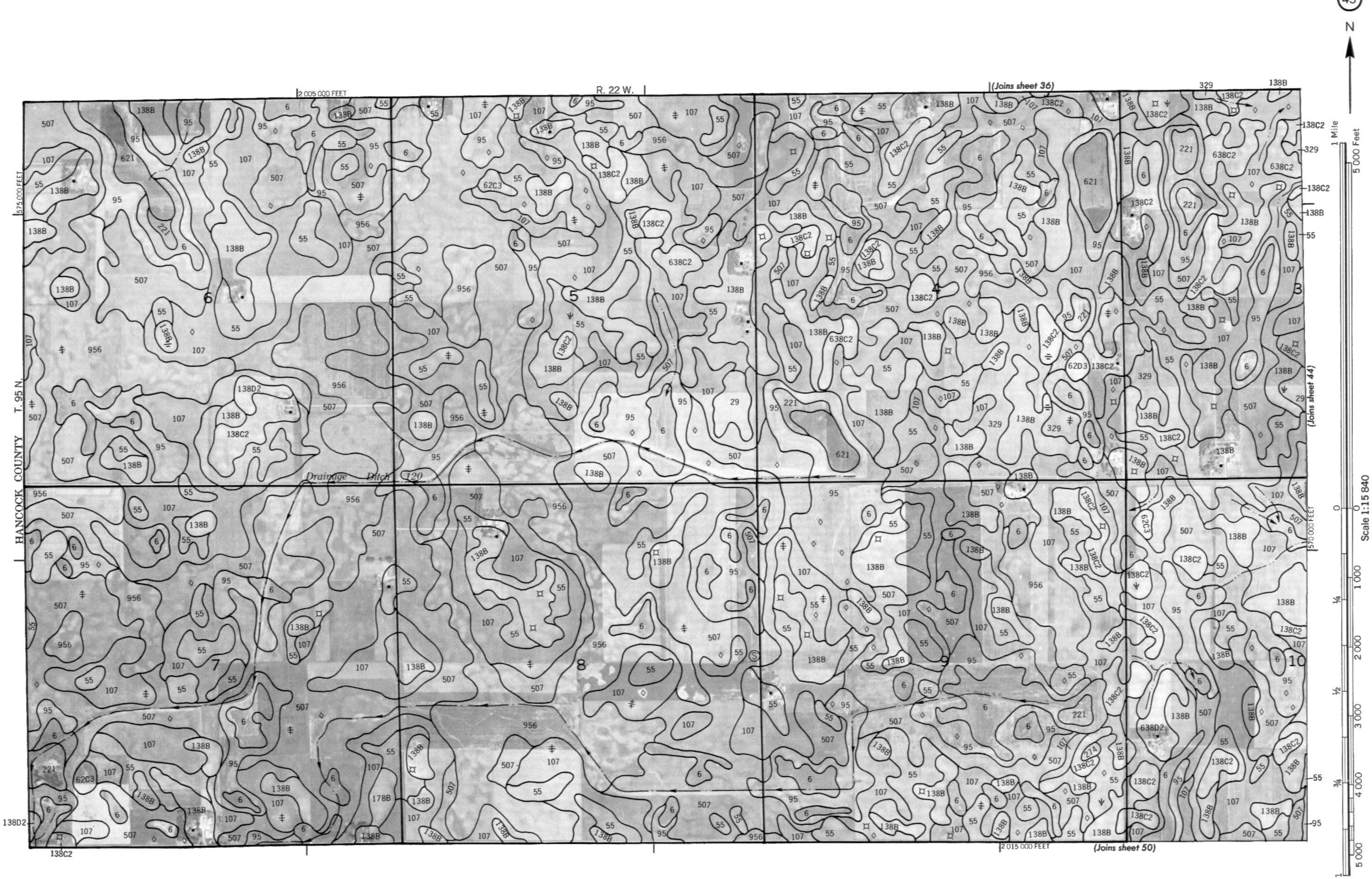

38
N
(Joins sheet 31)
R. 21 W.
2 055 000 FEET
585 000 FEET
(Joins sheet 37)
(Joins sheet 39)
T. 96 N.
(Joins sheet 45)
2 040 000 FEET
560 000 FEET
29
28
27
26
32
33
34
35
Crane
Creek
35
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1


39
N
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 46)
R. 21 W. | R. 20 W.
T. 96 N.
2 060 000 FEET
2 070 000 FEET
585 000 FEET
580 000 FEET
25
26
29
30
31
32
35
36
Chesléa Creek
CHICAGO AND NORTH WESTERN
CHICAGO ROCK ISLAND AND PACIFIC
1 Mile
5 000 Feet
Scale 1:15 840

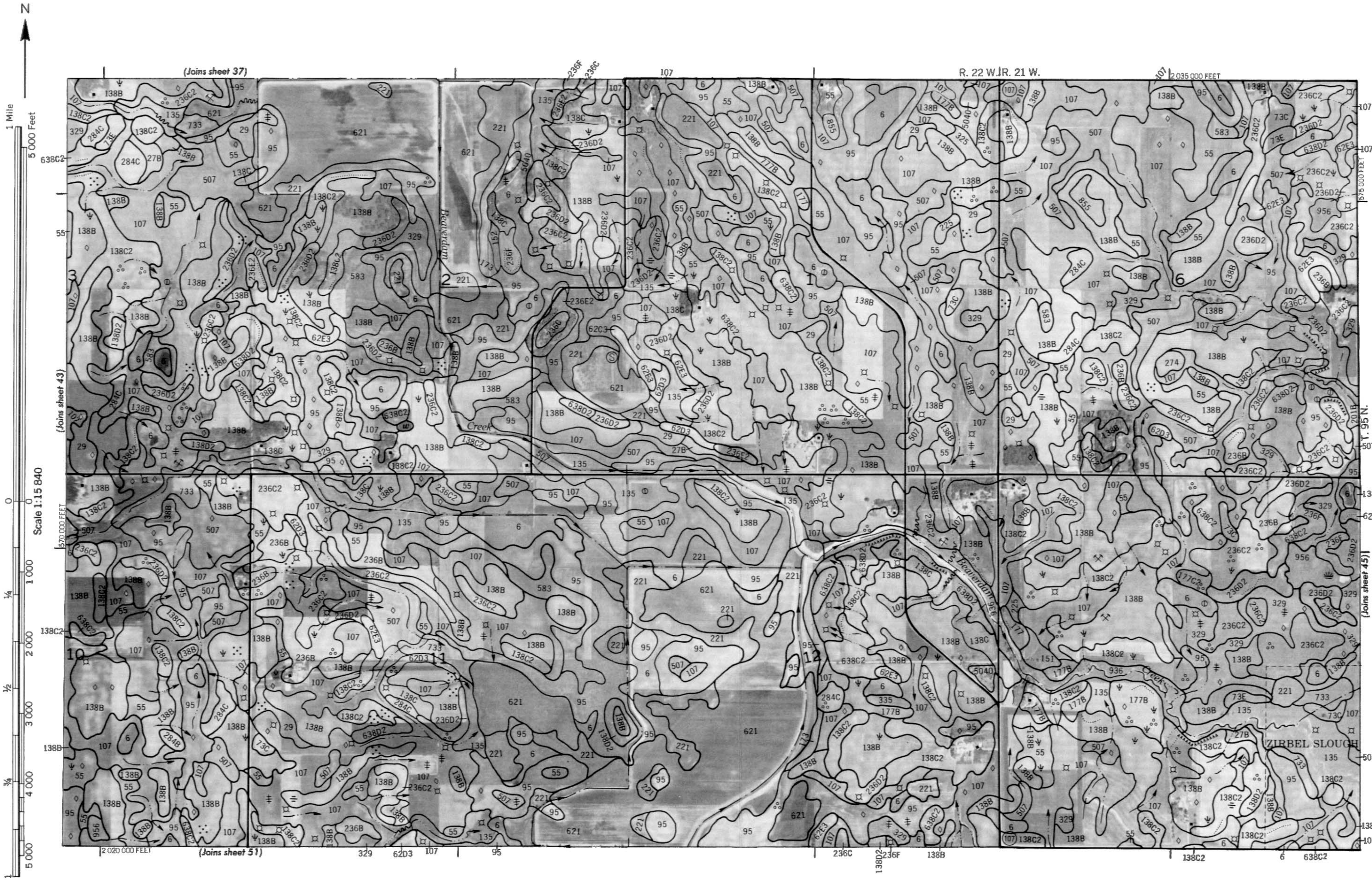

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 33)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 47)
R. 20 W.
T. 96 N.
2 090 000 FEET
2 075 000 FEET
585 000 FEET
590 000 FEET
FIN-FEATHER LAKE
water
CHICAGO AND NORTH WESTERN
Big Gully
25
26
27
28
33
34
35
36


N
R. 20 W.
R. 19 W.
2 095 000 FEET
(Joins sheet 34)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 48)
585 000 FEET
560 000 FEET
2 110 000 FEET
T. 96 N.
25
30
29
28
36
31
32
33
WINNEBAGO RIVER
Big
Gully
Little Lime Creek
1 Mile
5 000 Feet
Scale 1:15 840

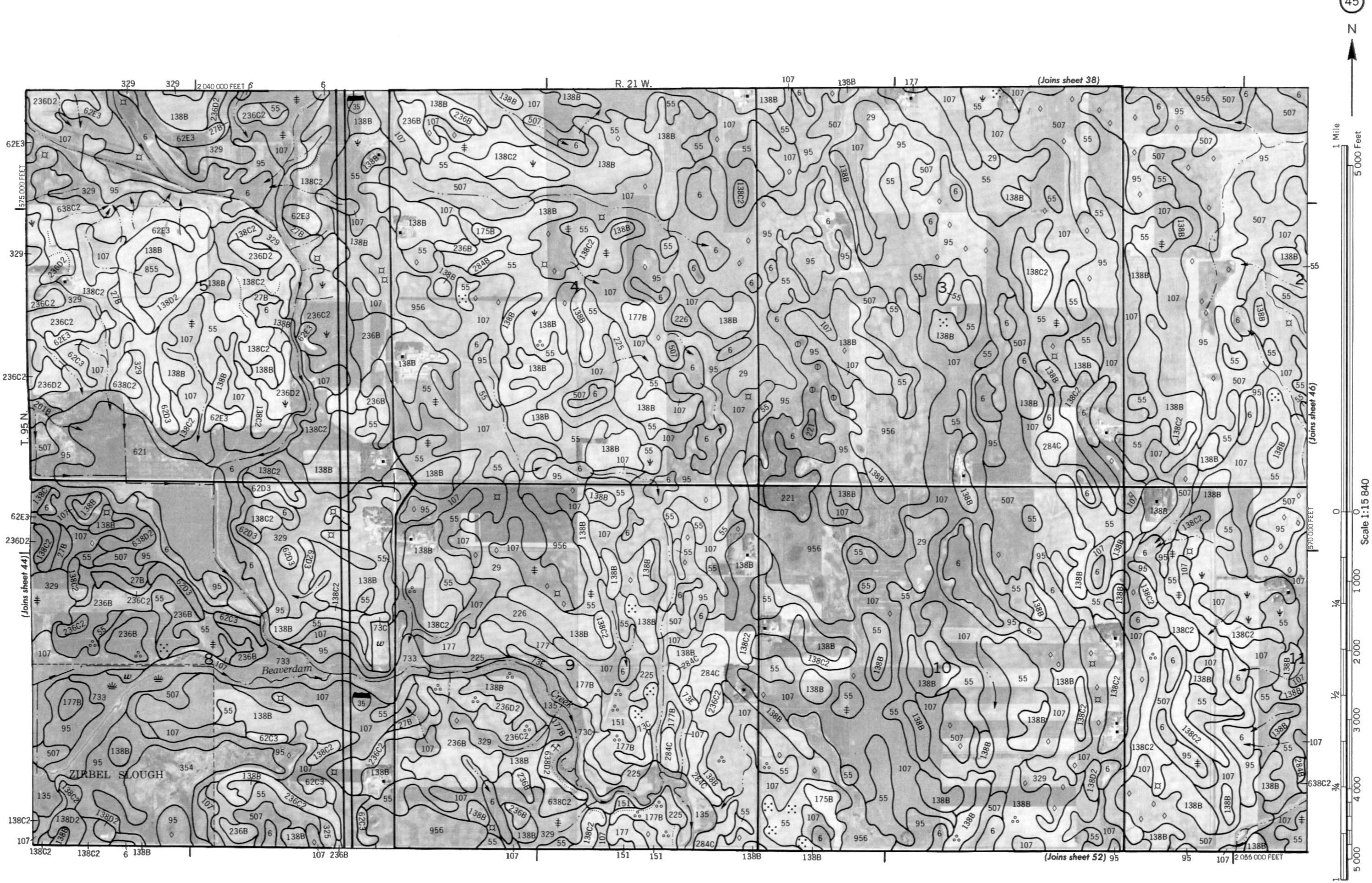

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 35)
R. 19 W.
2 125 000 FEET
585 000 FEET
(Joins sheet 41)
580 000 FEET
(Joins sheet 49)
2 115 000 FEET
FLOYD COUNTY
T. 96 N.
Little
Lime
Creek
WINNEBAGO
RIVER
CLAY BANKS AREA
water
26
27
25
34
35
36

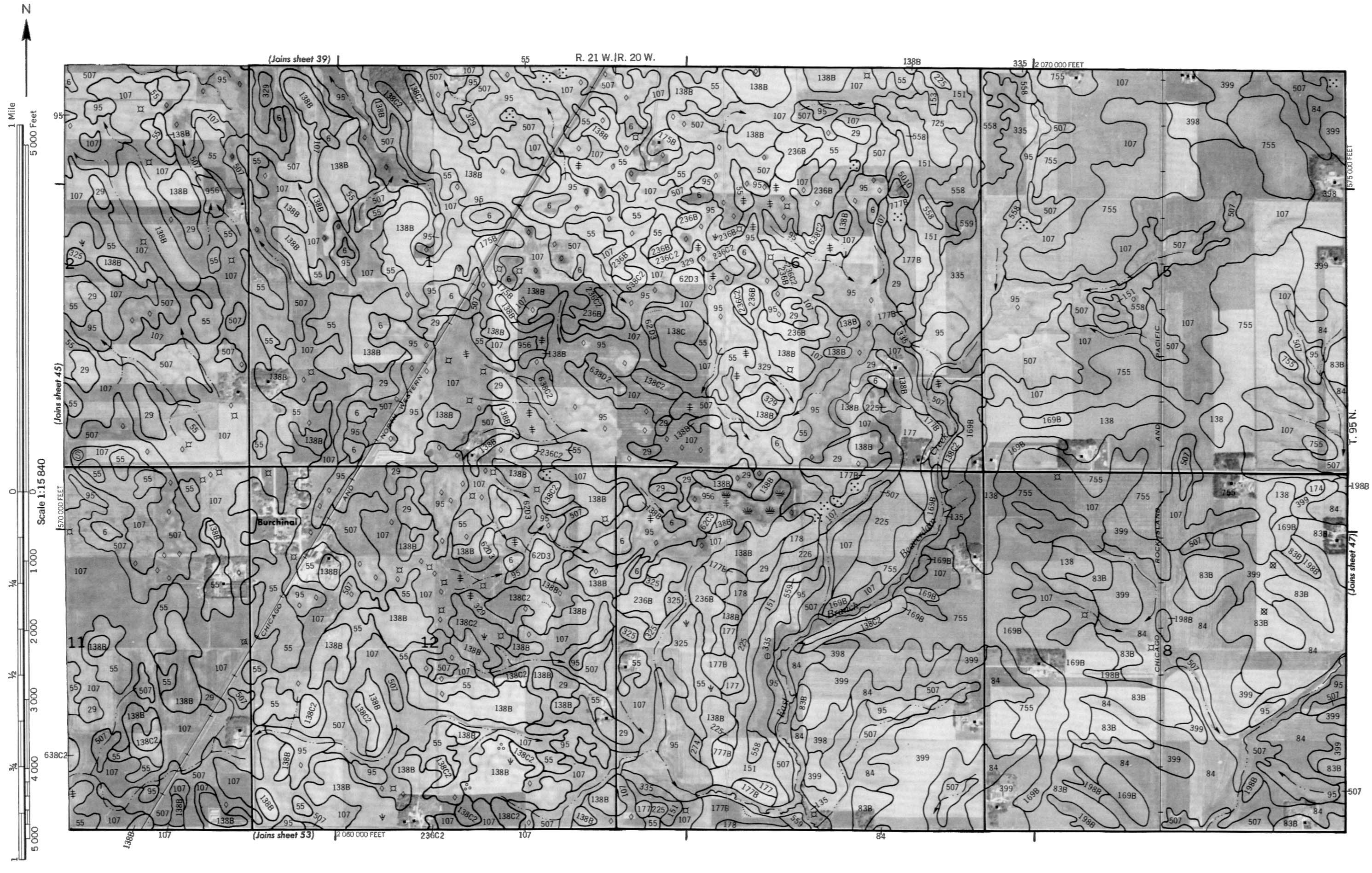

N
R. 22 W.
T. 95 N.
HANCOCK COUNTY
(Joins sheet 36)
(Joins sheet 44)
(Joins sheet 50)
Drainage Ditch 120
2 005 000 FEET
2 015 000 FEET
575 000 FEET
570 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

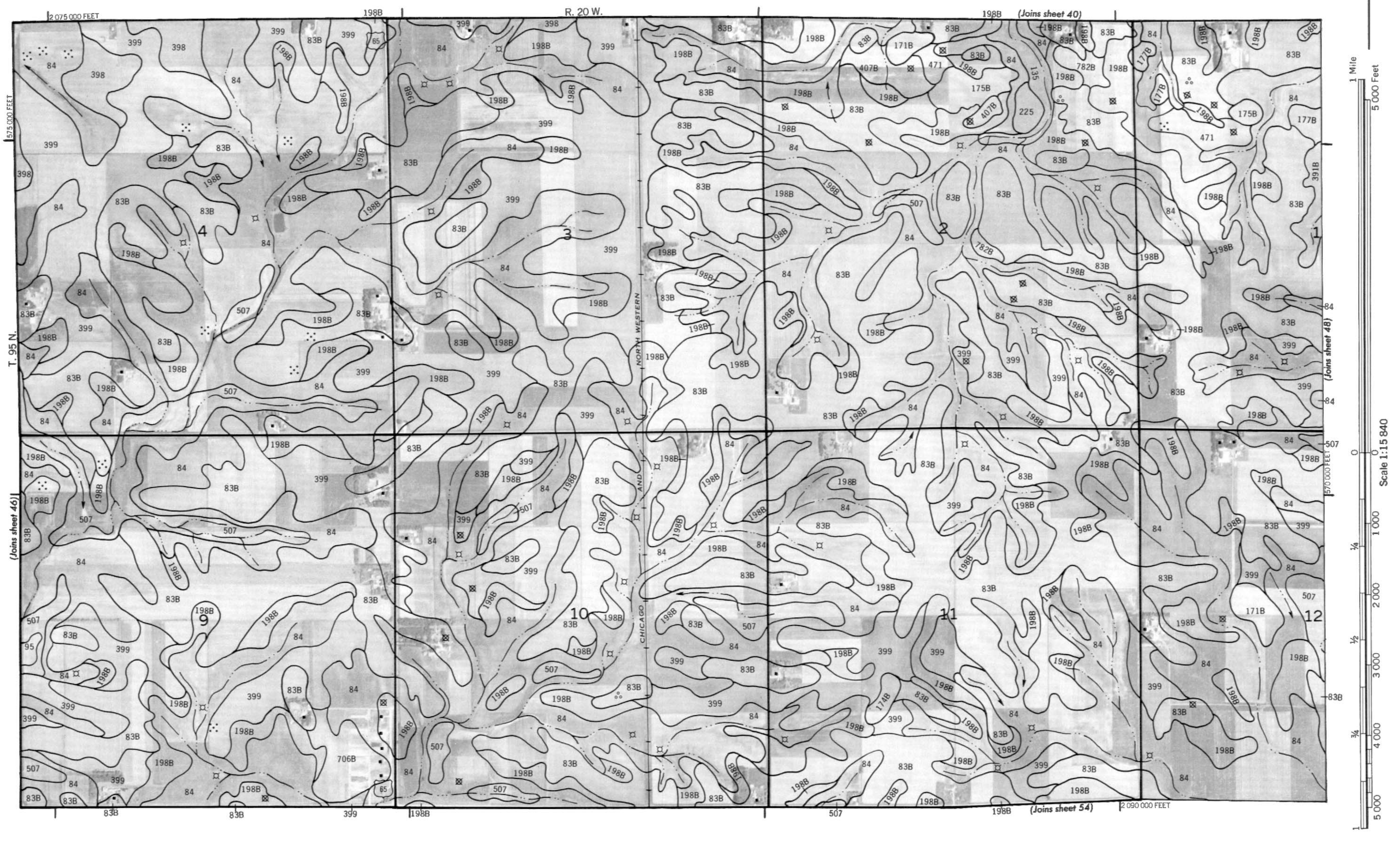
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 44



CERRO GORDO COUNTY, IOWA — SHEET NUMBER 45



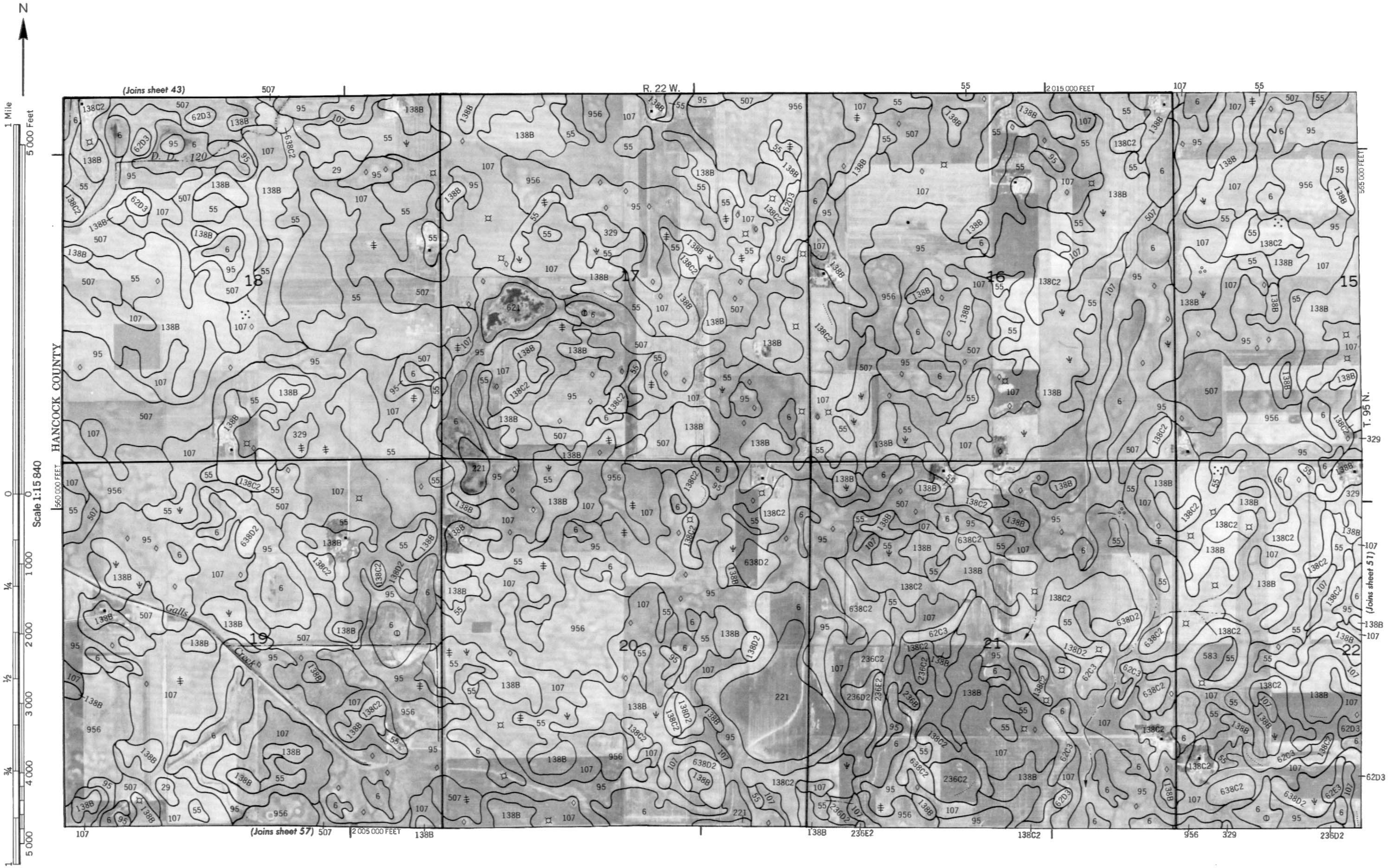

N
1 Mile
5 000 Feet
0
Scale 1:15 840
(Joins sheet 39)
R. 21 W. | R. 20 W.
2 070 000 FEET
575 000 FEET
570 000 FEET
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 53)
2 060 000 FEET
T. 95 N.
Burchinal
CHICAGO AND NORTH WESTERN
CHICAGO ROCK ISLAND AND PACIFIC
Beaverdam Creek
Bear Branch

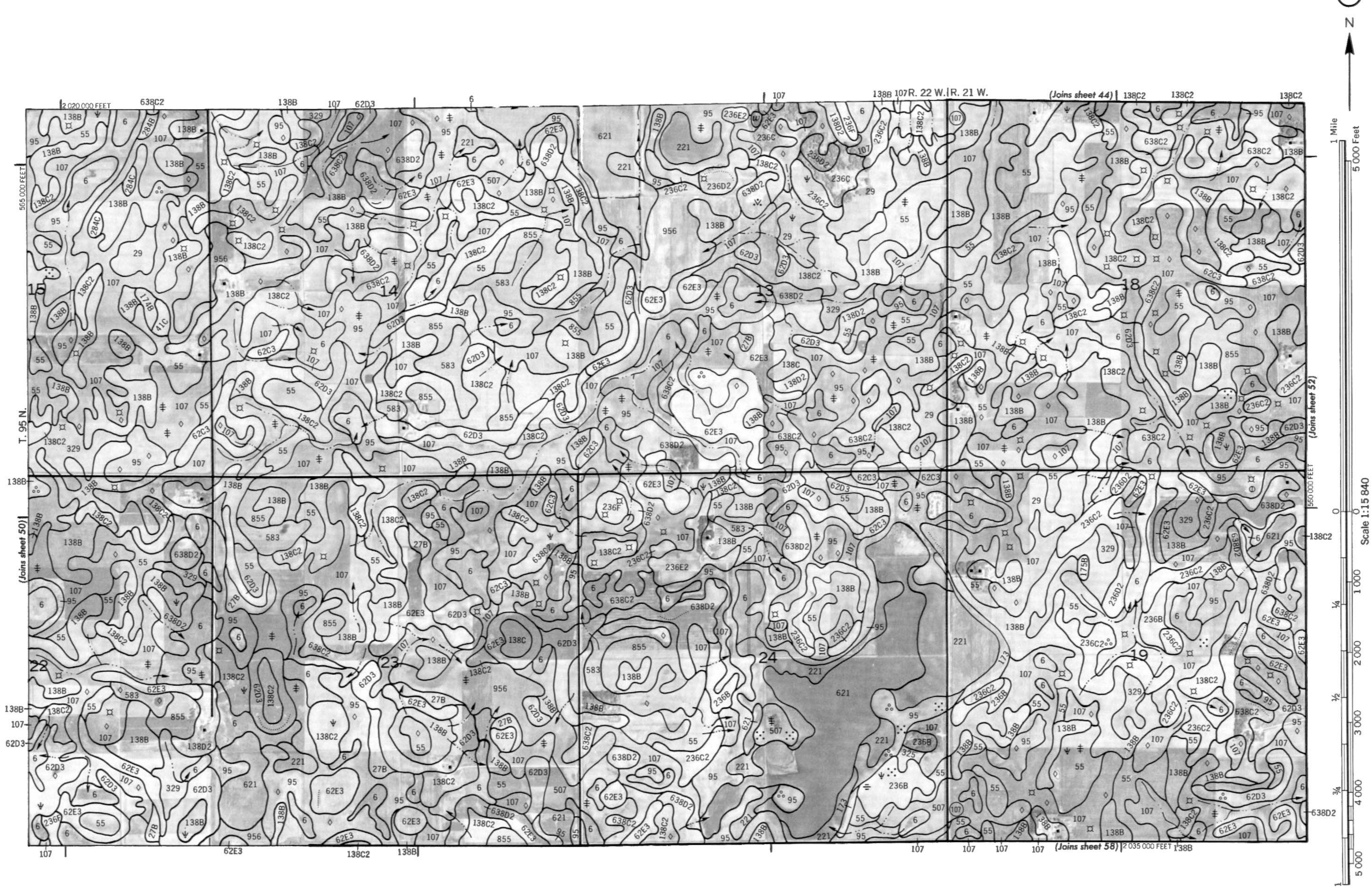

N
R. 20 W.
T. 95 N.
(Joins sheet 40)
(Joins sheet 46)
(Joins sheet 48)
(Joins sheet 54)
2 075 000 FEET
575 000 FEET
570 000 FEET
2 090 000 FEET
CHICAGO AND NORTH WESTERN
1 Mile
5 000 Feet
Scale 1:15 840

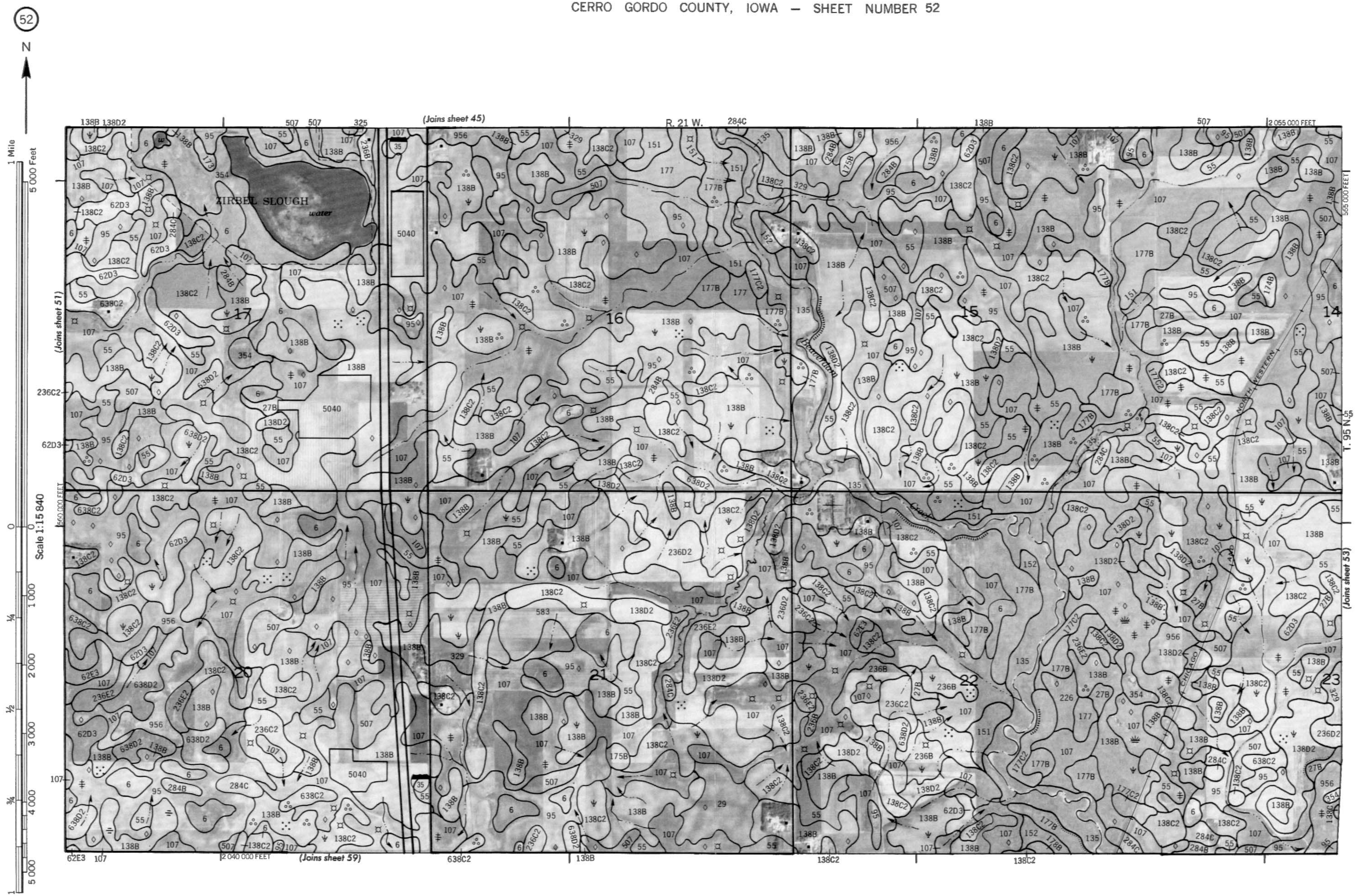

N
1 Mile
5 000 Feet
Scale 1:15 840
R. 20 W.
R. 19 W.
(Joins sheet 41)
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 55)
Hanford
CHICAGO
AND
NORTH WESTERN
Bad
Lands
Draw
T. 95 N.
2 110 000 FEET
575 000 FEET
570 000 FEET
2 095 000 FEET


49
N
R. 19 W.
T. 95 N.
(Joins sheet 42)
(Joins sheet 48)
(Joins sheet 56)
FLOYD COUNTY
Rock Creek
Bad Lands Draw
575 000 FEET
570 000 FEET
2 115 000 FEET
2 125 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet

CERRO GORDO COUNTY, IOWA — SHEET NUMBER 50

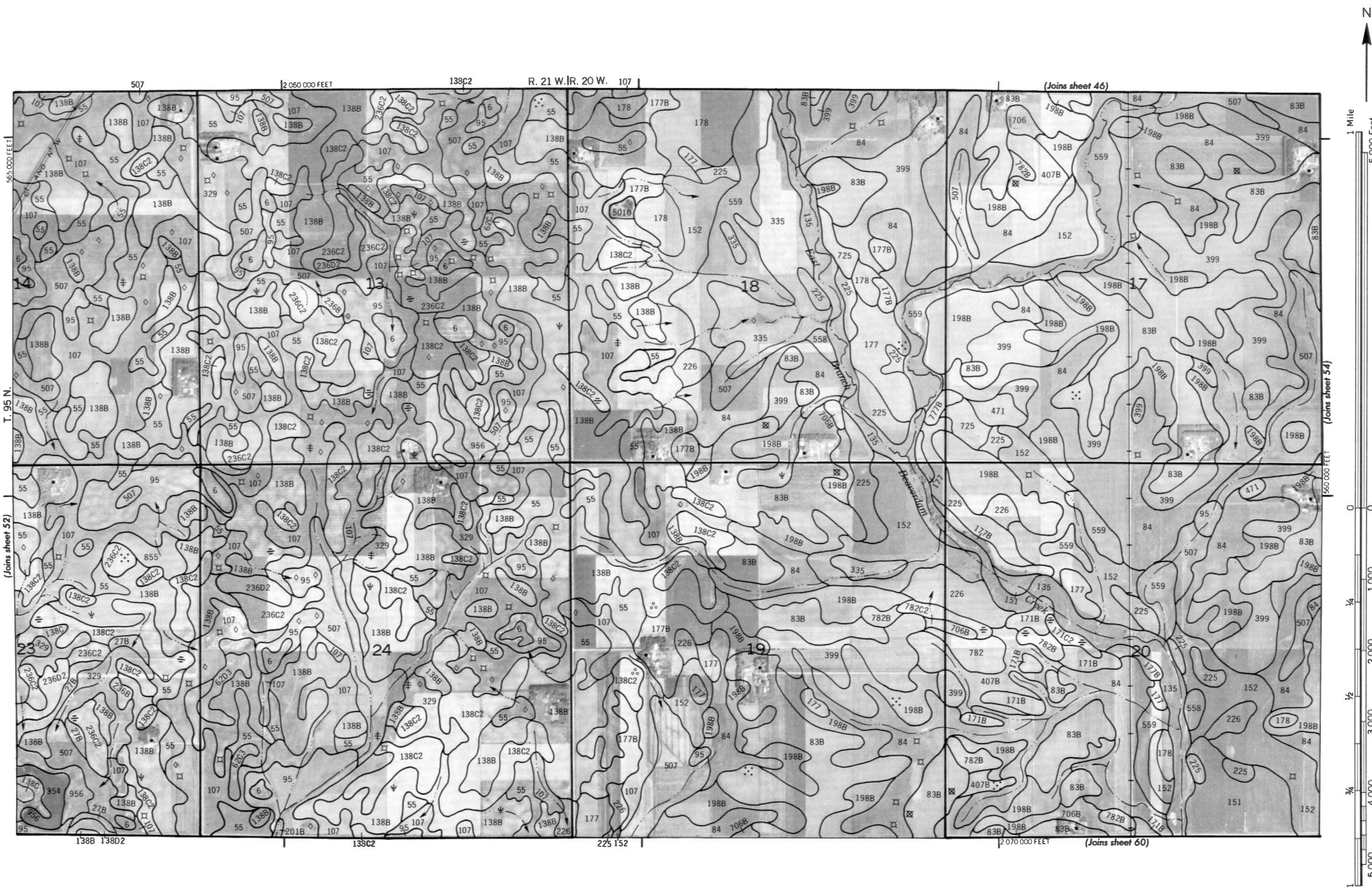


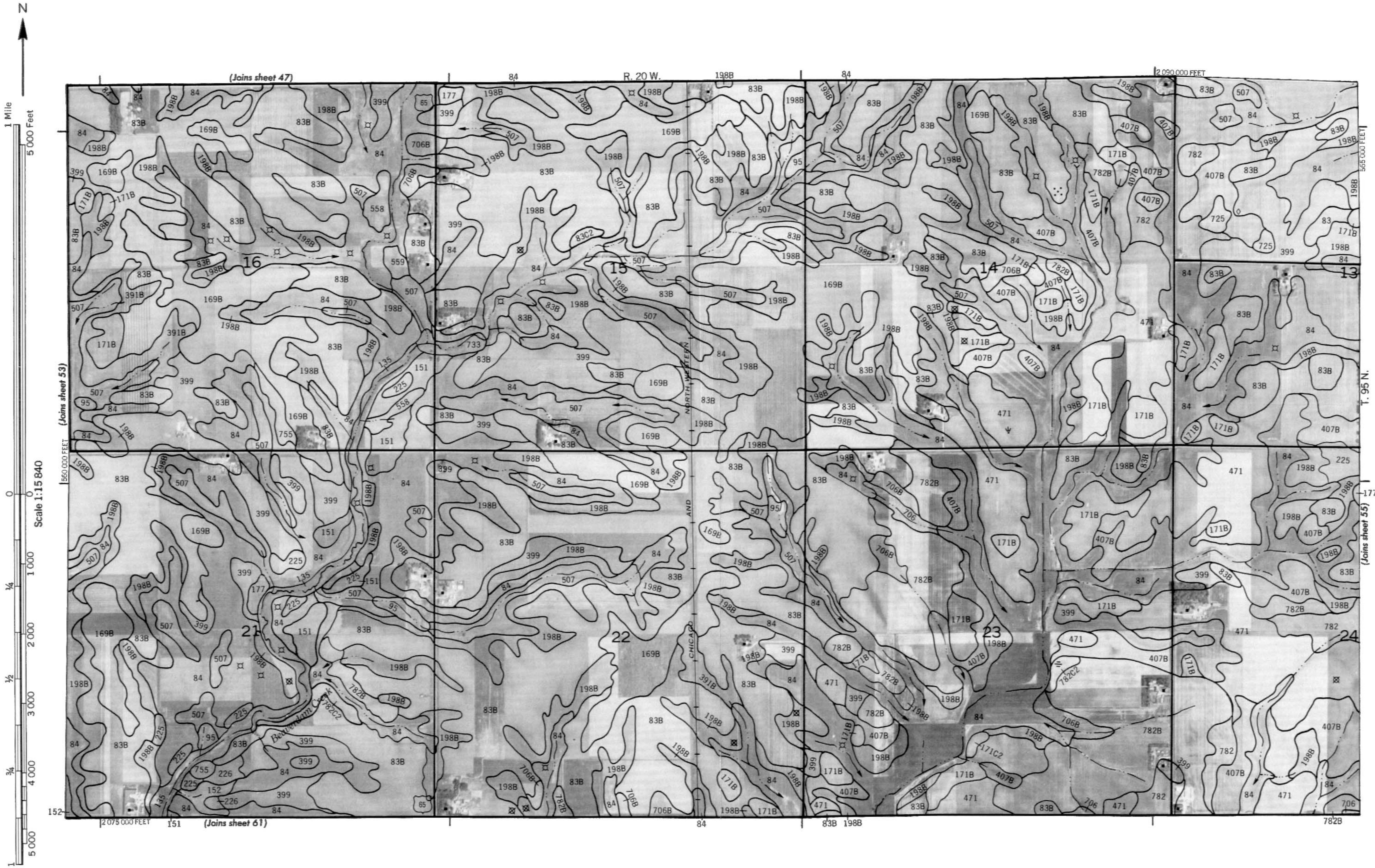

51
N
(Joins sheet 44)
R. 22 W.
R. 21 W.
T. 95 N.
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 58)
2 020 000 FEET
2 035 000 FEET
565 000 FEET
560 000 FEET
15
14
13
18
22
23
24
19
1 Mile
5 000 Feet
Scale 1:15 840

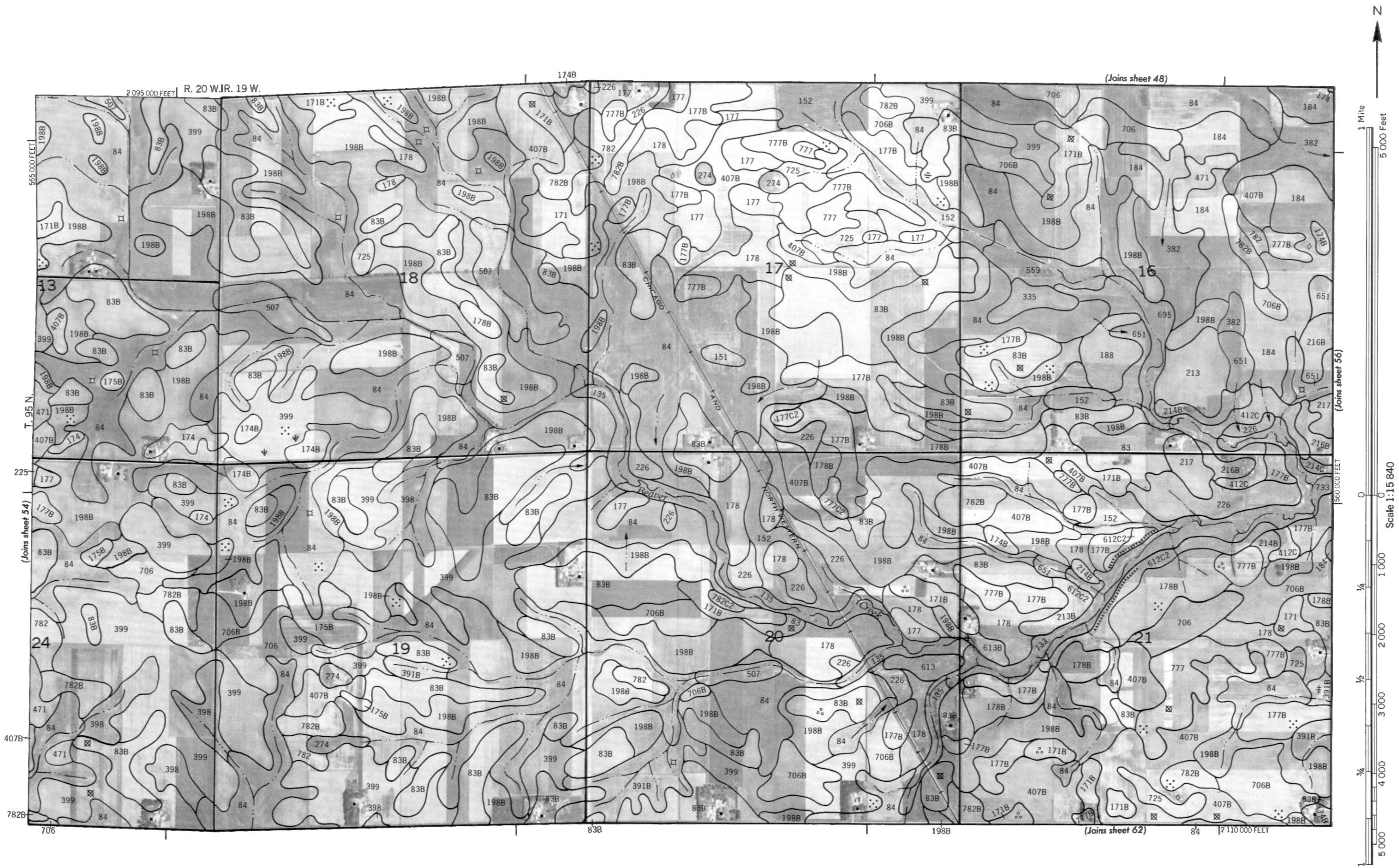

52
N
ZIRBEL SLOUGH
water
(Joins sheet 45)
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 59)
R. 21 W.
T. 95 N.
2 055 000 FEET
2 040 000 FEET
565 000 FEET
560 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
CHICAGO AND NORTH WESTERN
17
16
15
14
20
21
22
23

CERRO GORDO COUNTY, IOWA — SHEET NUMBER 53

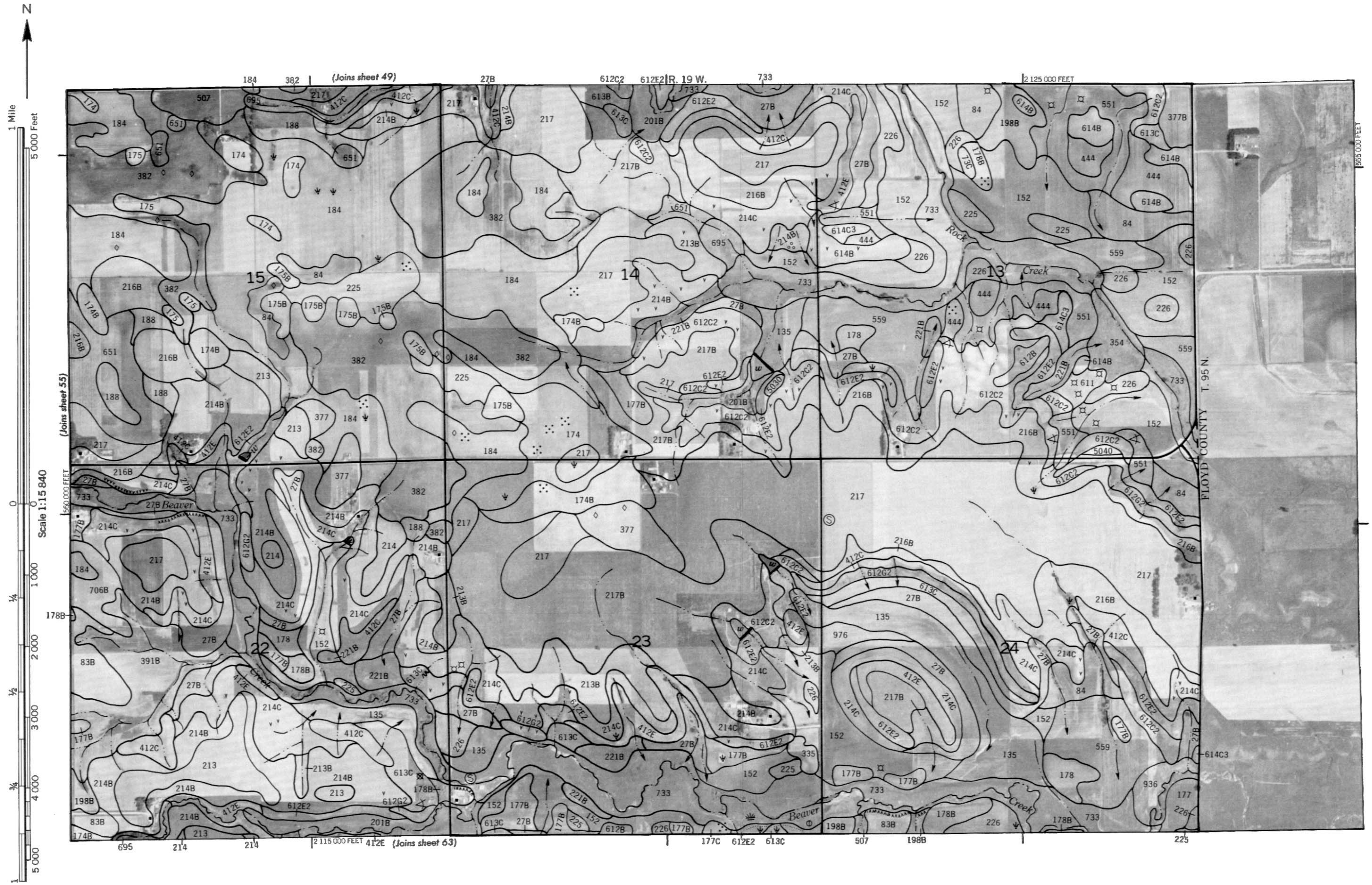
53

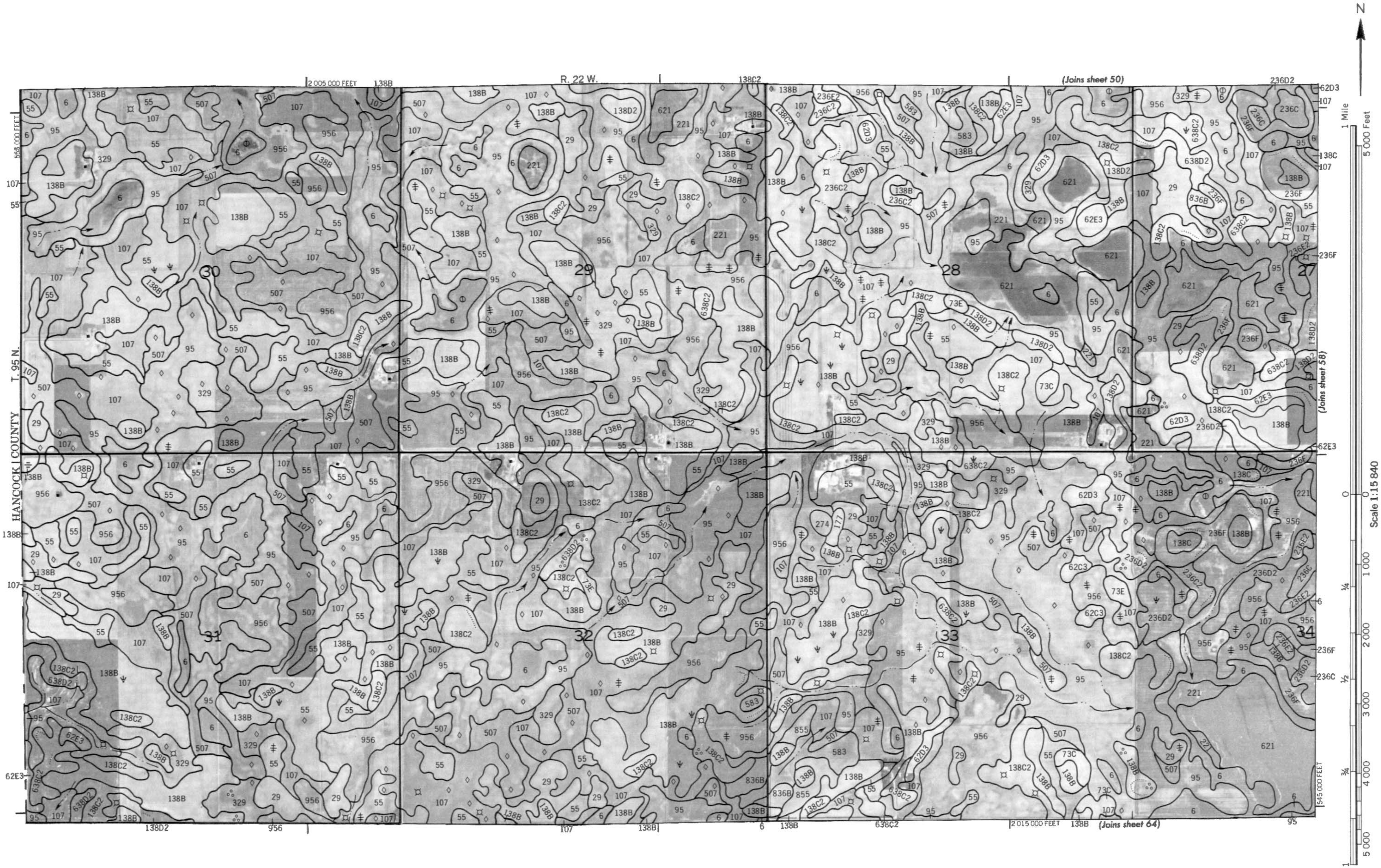



N
(Joins sheet 47)
(Joins sheet 53)
(Joins sheet 55)
(Joins sheet 61)
R. 20 W.
T. 95 N.
2 090 000 FEET
2 075 000 FEET
565 000 FEET
560 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
CHICAGO AND NORTH WESTERN
Beaverdam Creek
16
15
14
13
21
22
23
24

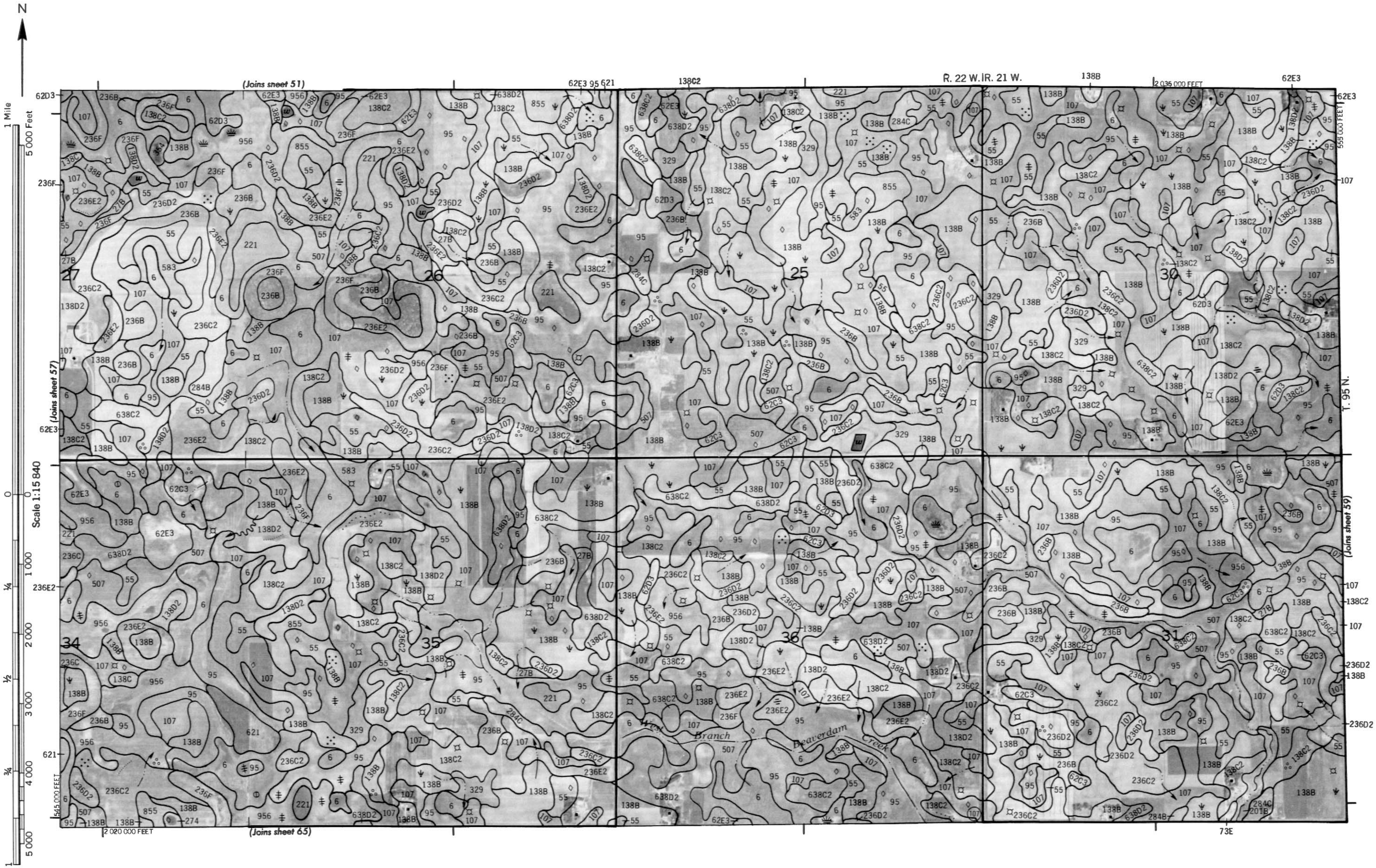

N
(Joins sheet 48)
(Joins sheet 56)
(Joins sheet 62)
(Joins sheet 54)
R. 20 W. | R. 19 W.
T. 95 N.
2 095 000 FEET
2 110 000 FEET
565 000 FEET
560 000 FEET
13
18
17
16
24
19
20
21
CHICAGO AND NORTH WESTERN
Beaver Creek
Scale 1:15 840
1 Mile
5 000 Feet

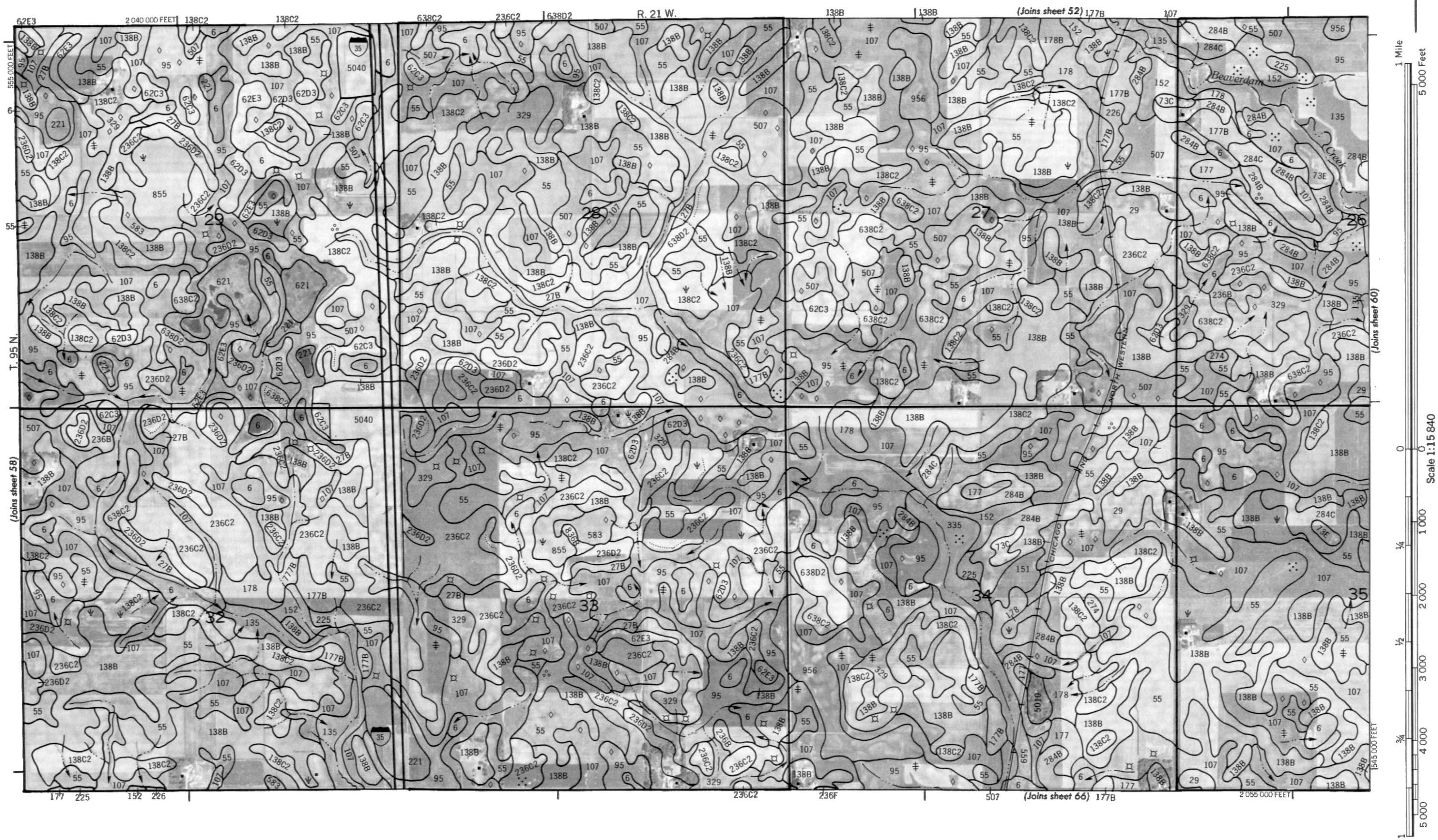
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 56



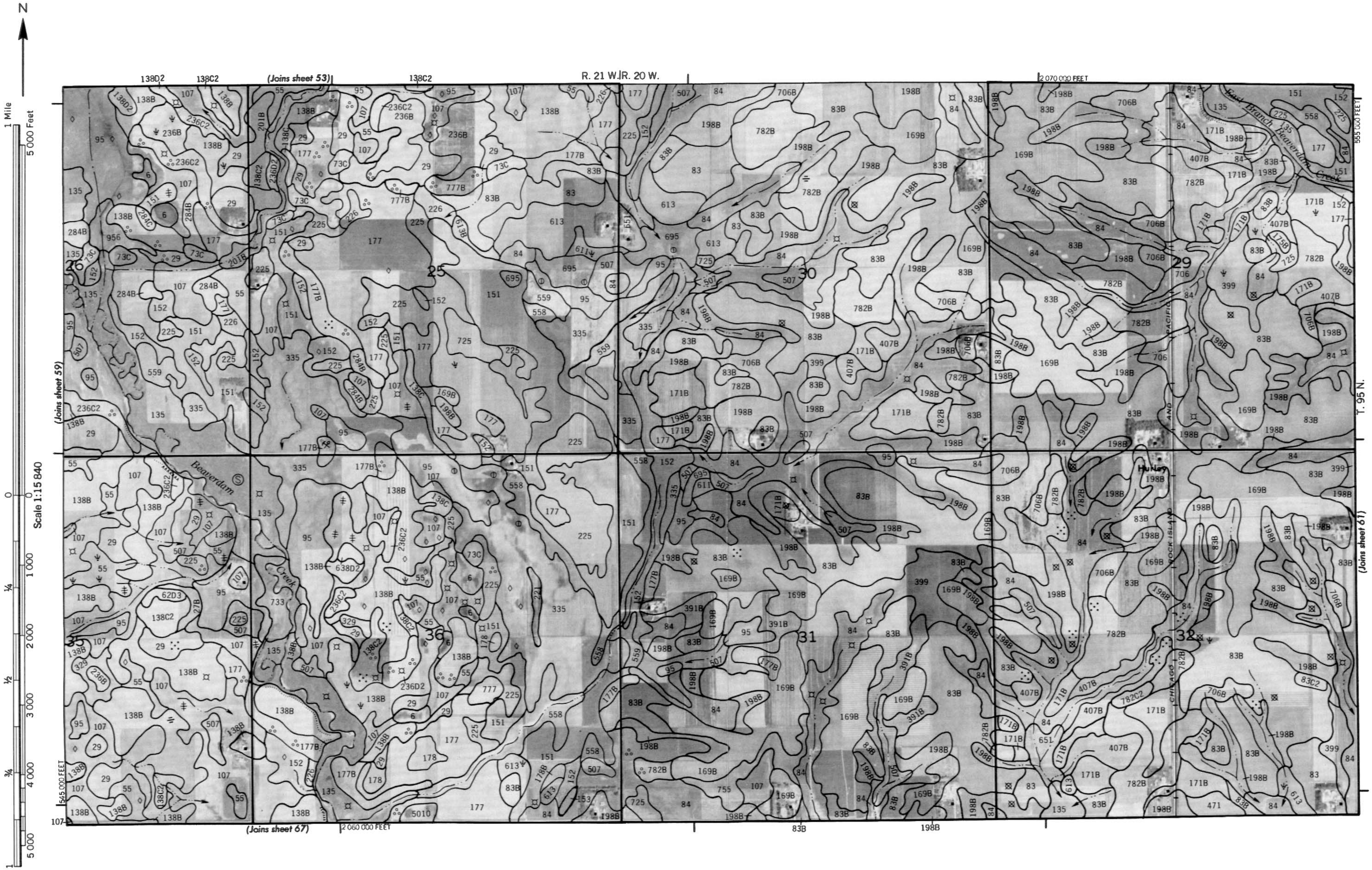

N
R. 22 W.
(Joins sheet 50)
(Joins sheet 58)
(Joins sheet 64)
T. 95 N.
HANCOCK COUNTY
2 005 000 FEET
2 015 000 FEET
555 000 FEET
545 000 FEET
30
29
28
27
31
32
33
34
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

CERRO GORDO COUNTY, IOWA — SHEET NUMBER 58

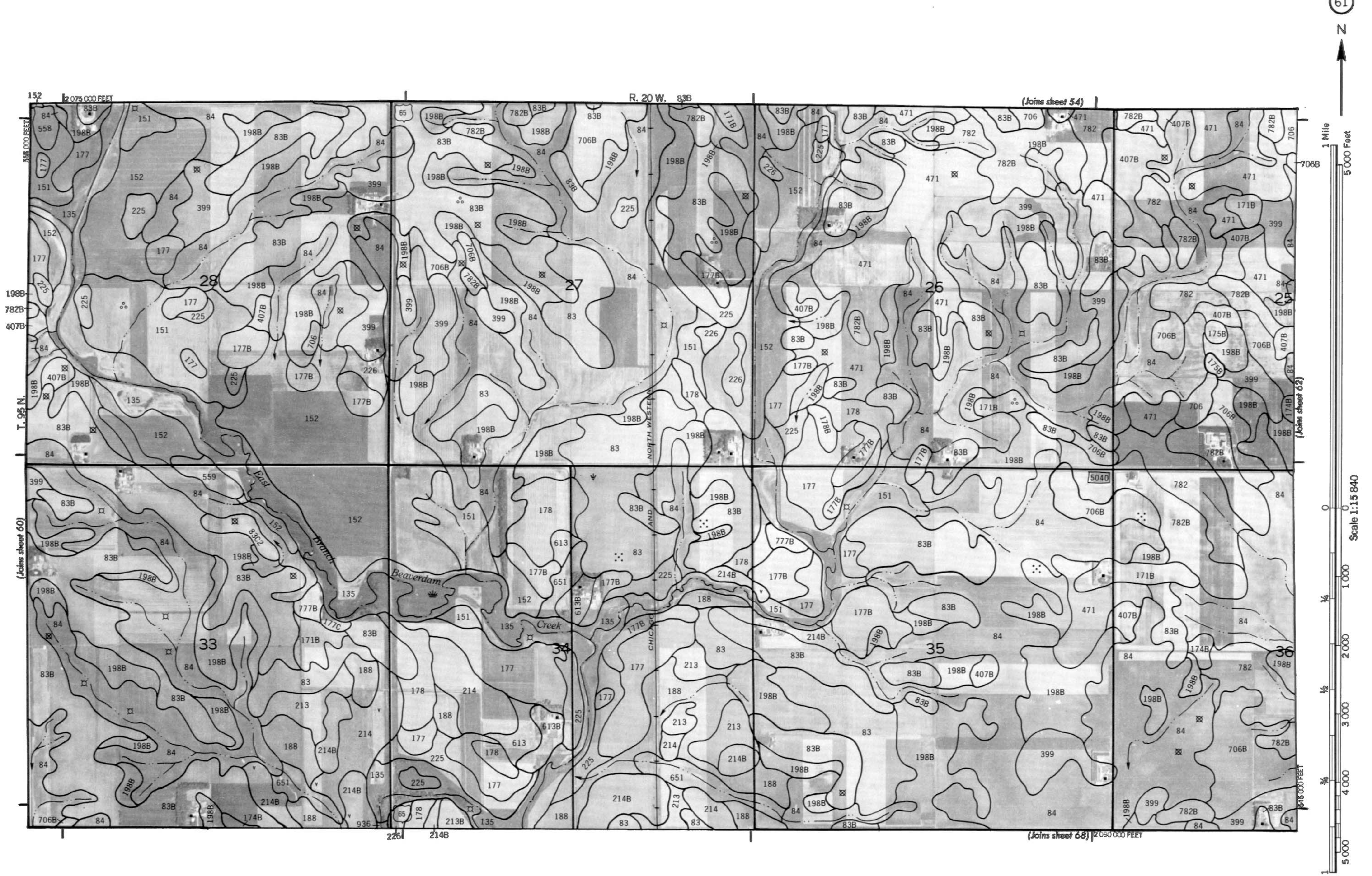


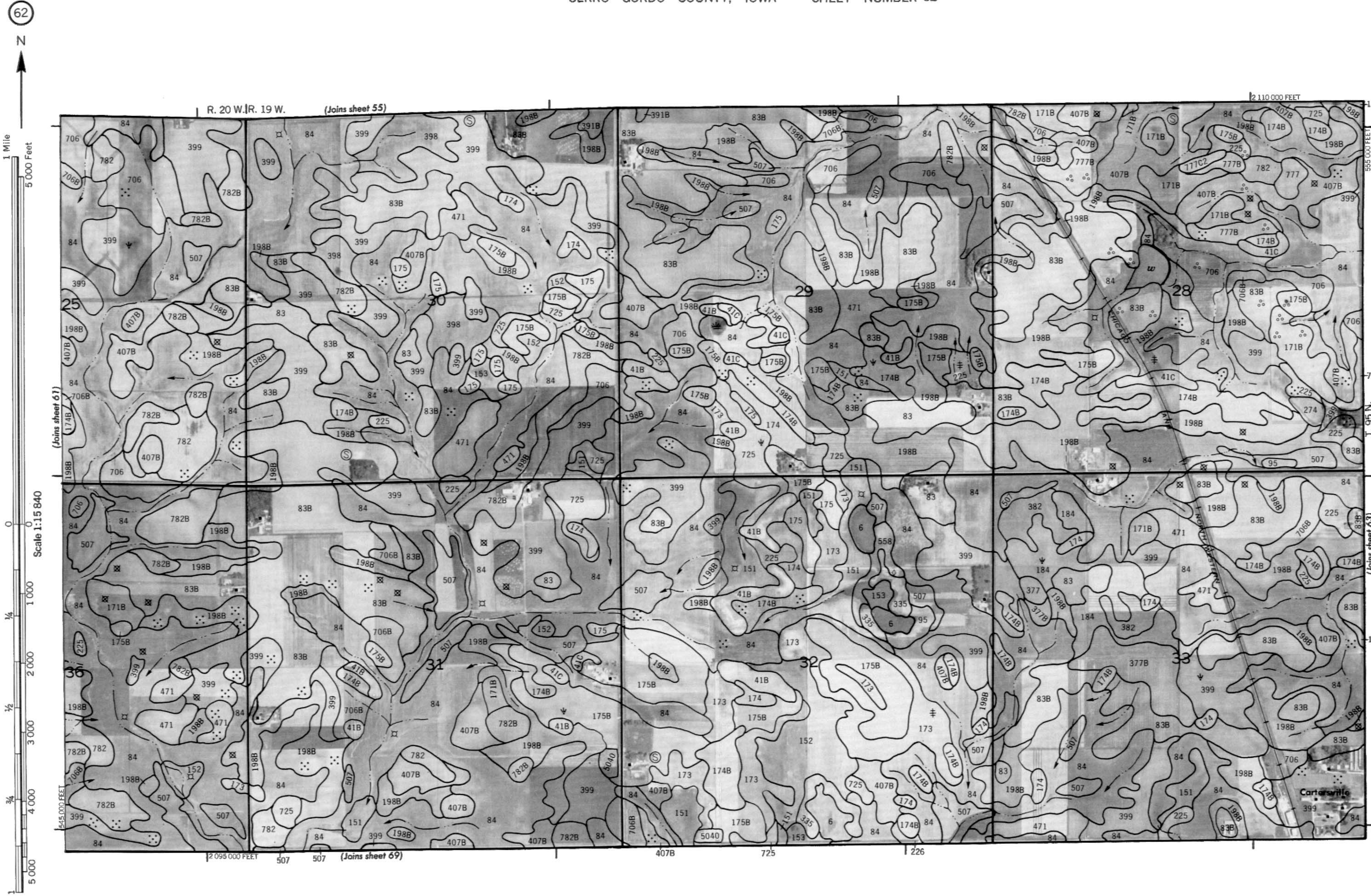

N
R. 21 W.
T. 95 N.
(Joins sheet 52)
(Joins sheet 66)
(Joins sheet 58)
(Joins sheet 60)
2 040 000 FEET
2 055 000 FEET
555 000 FEET
545 000 FEET
29
28
27
26
32
33
34
35
Beaverdam Creek
CHICAGO AND NORTH WESTERN
1 Mile
5 000 Feet
Scale 1:15 840
1 Kilometer
5 000

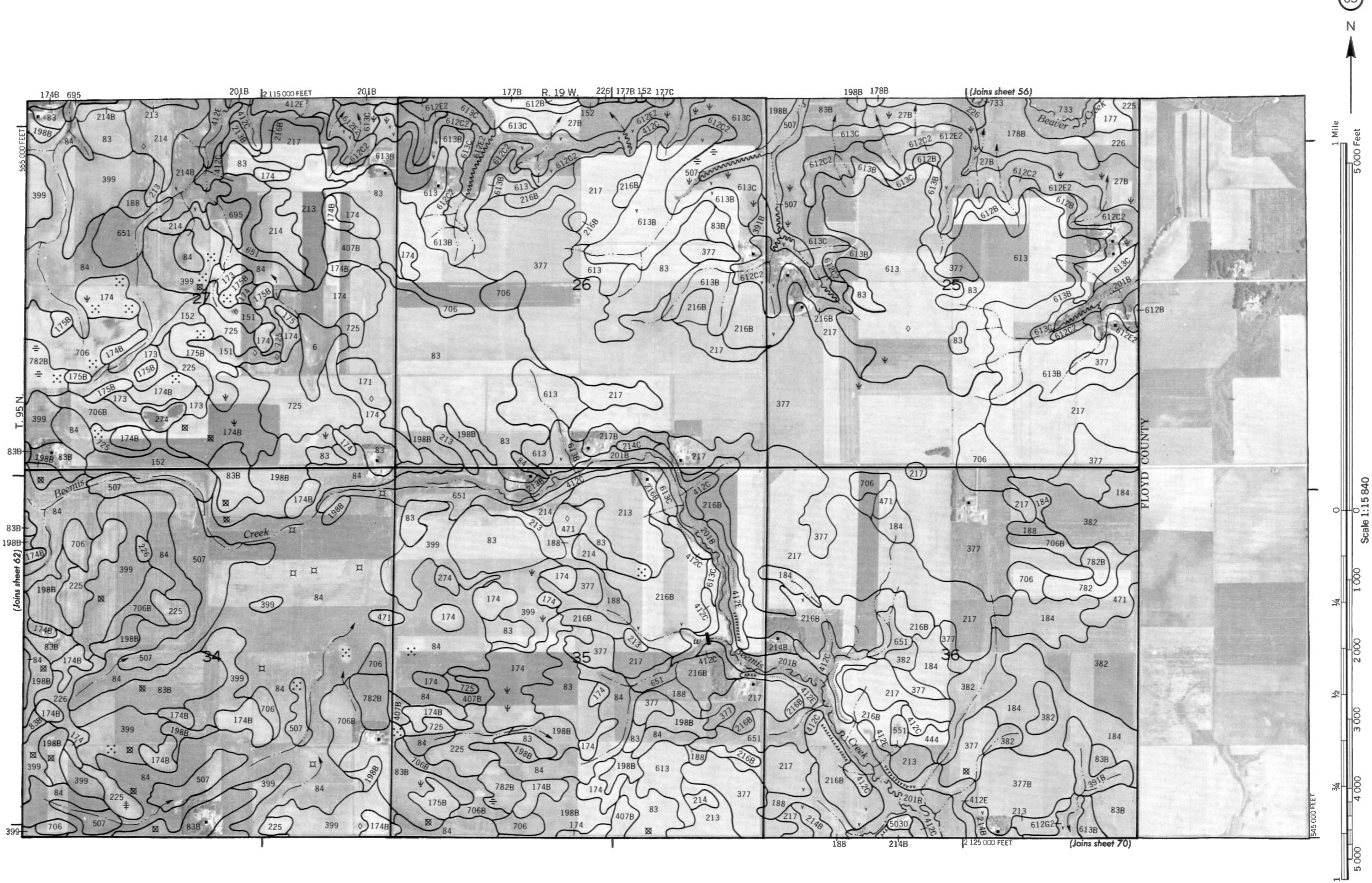
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 60



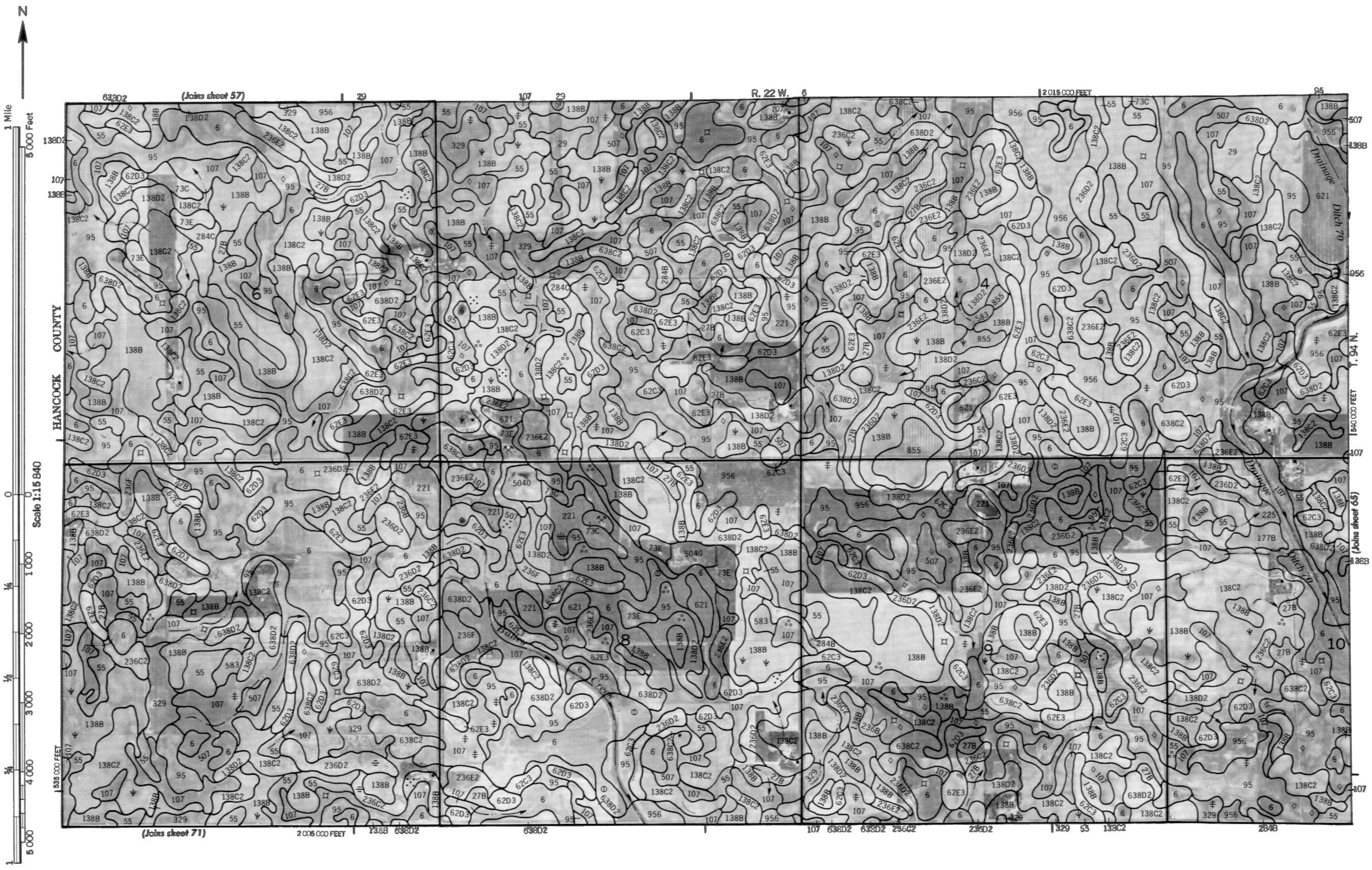
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 61

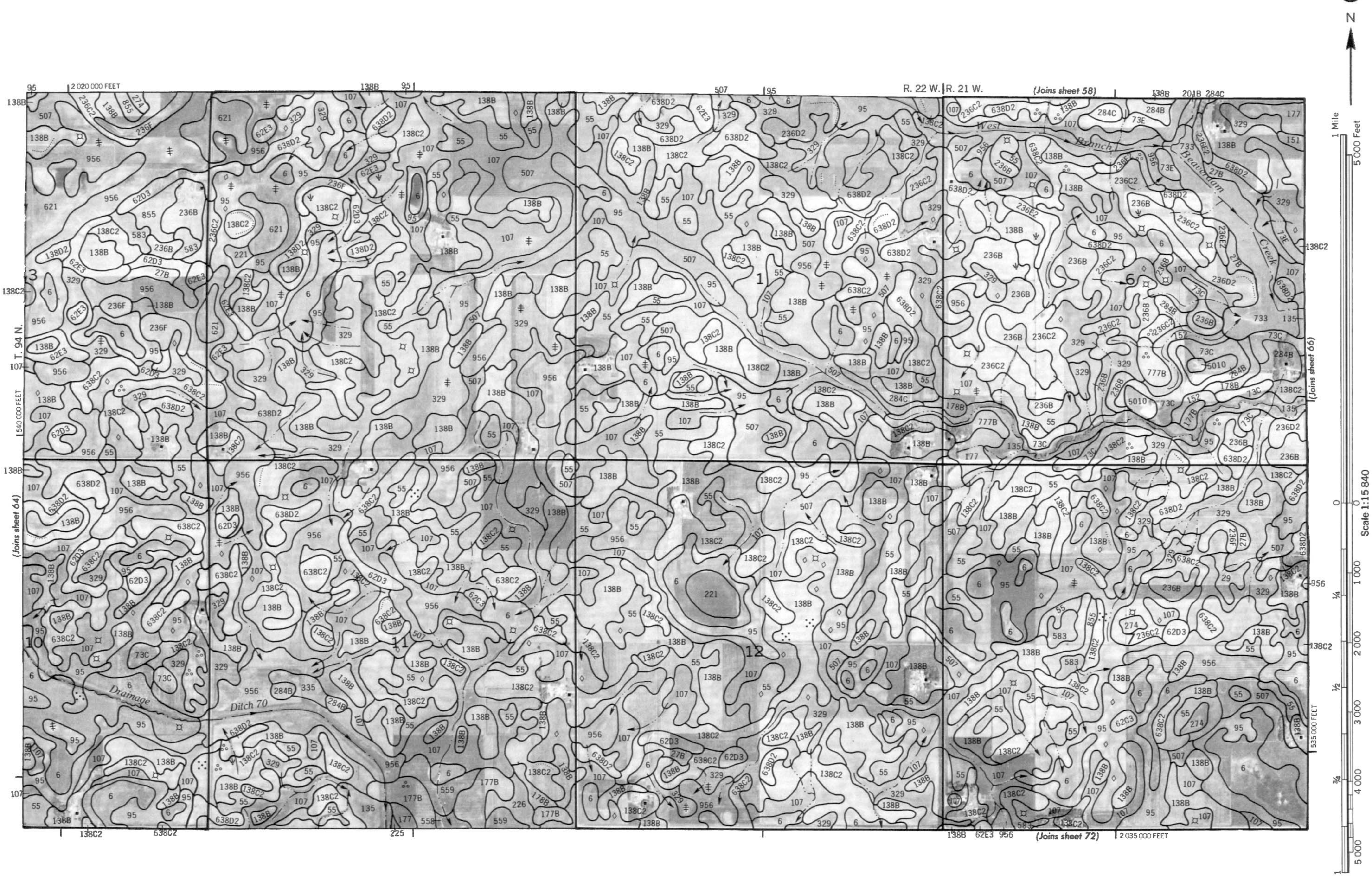



62
N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
0
¼
½
¾
R. 20 W.
R. 19 W.
(Joins sheet 55)
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 69)
T. 95 N.
2 110 000 FEET
555 000 FEET
545 000 FEET
2 095 000 FEET
25
30
29
28
36
31
32
33
CHICAGO AND NORTH WESTERN
Cartersville

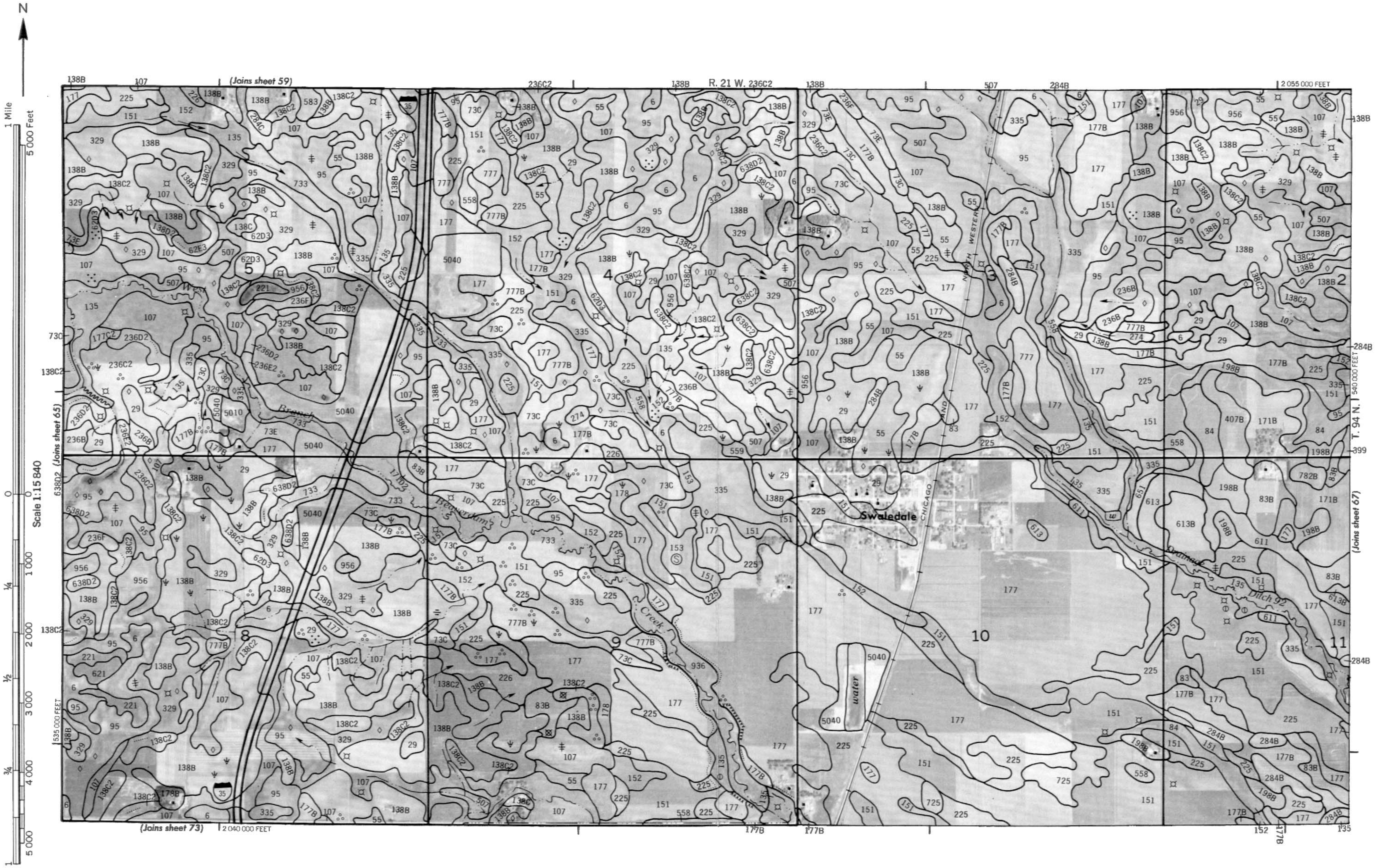

63
N
R. 19 W.
T. 95 N.
2 115 000 FEET
2 125 000 FEET
555 000 FEET
545 000 FEET
(Joins sheet 56)
(Joins sheet 62)
(Joins sheet 70)
FLOYD COUNTY
Beaver Creek
Beemis Creek
27
26
25
34
35
36
Scale 1:15 840
1 Mile
5 000 Feet

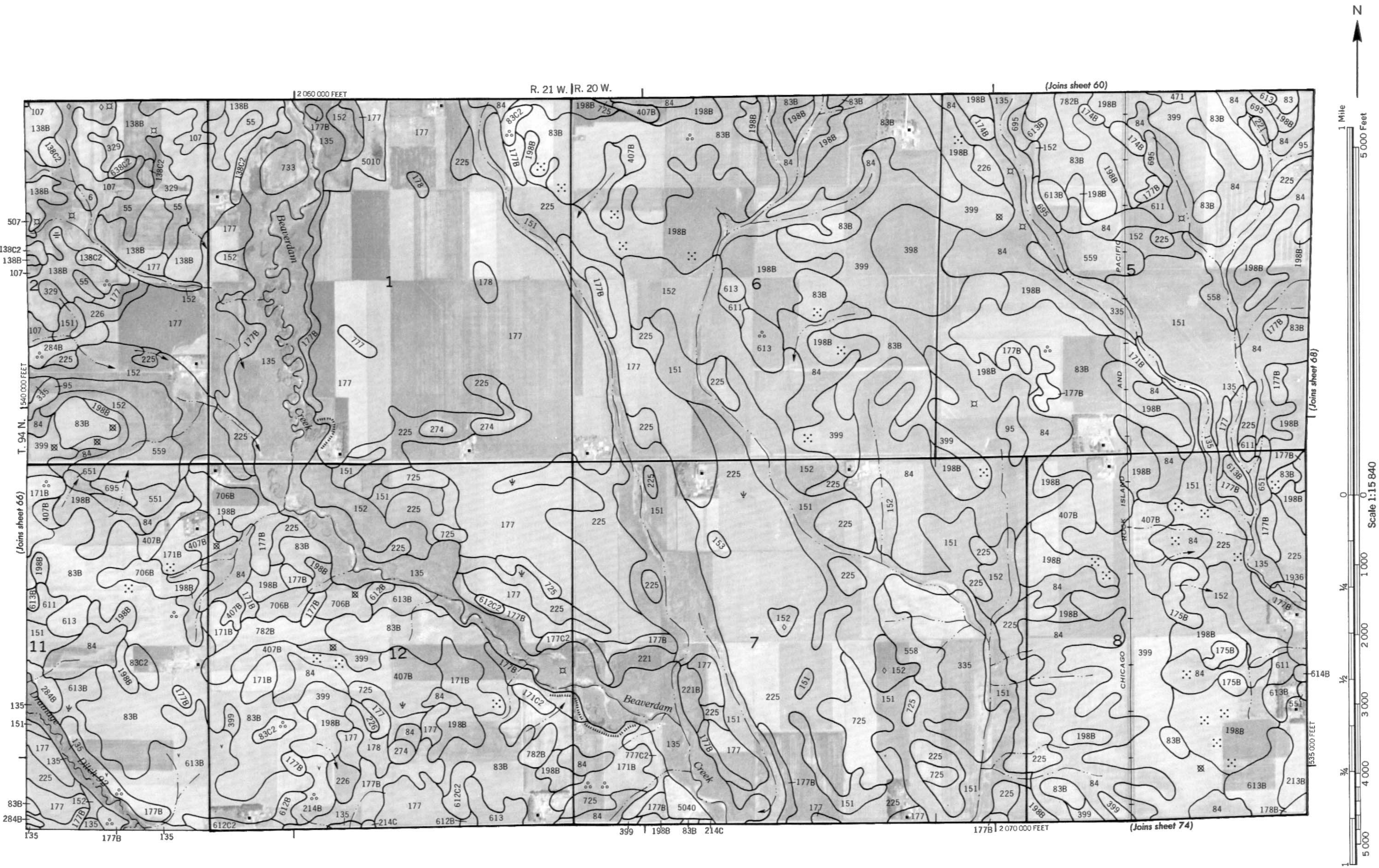
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 64



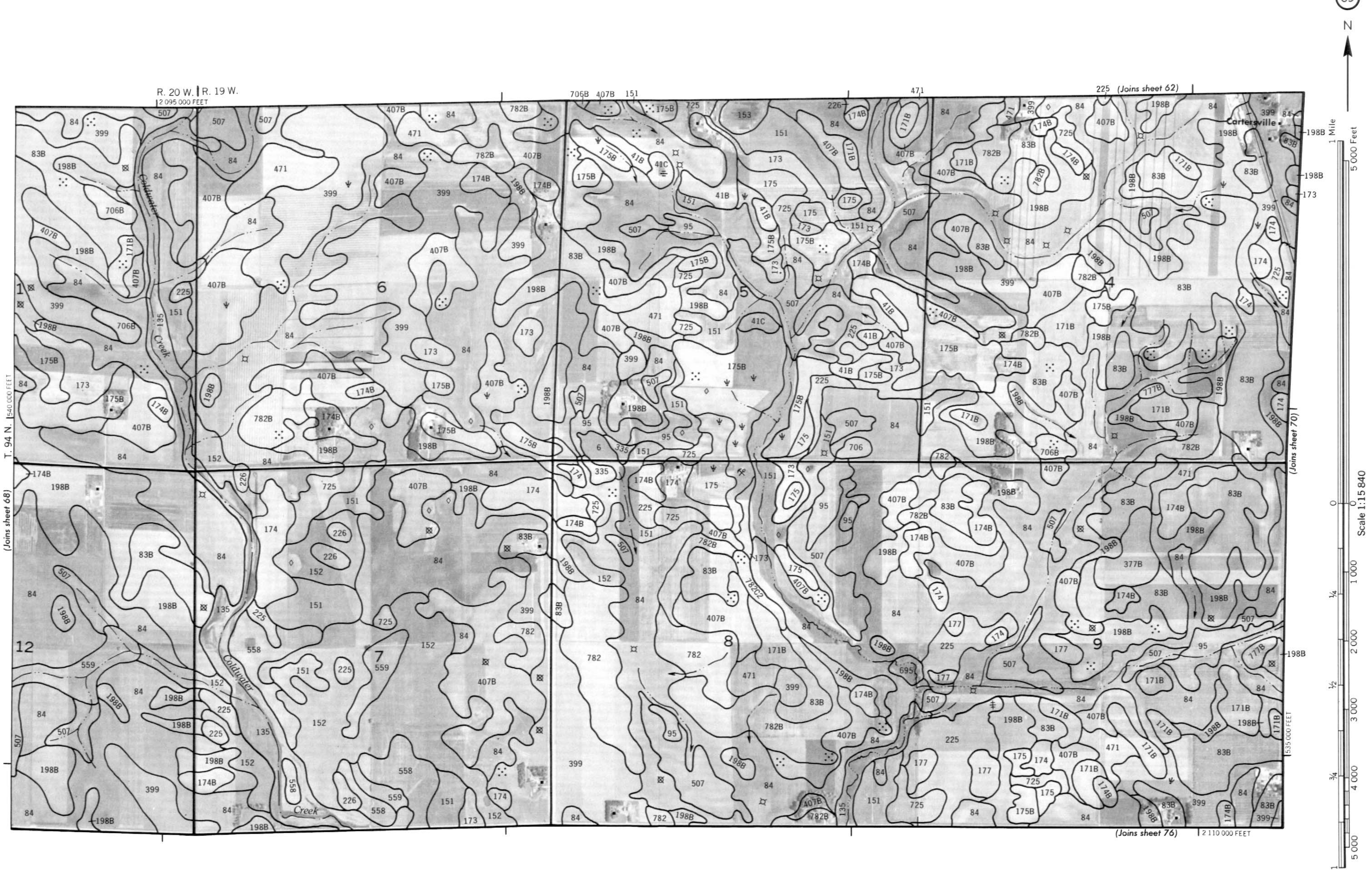

65
N
(Joins sheet 58)
(Joins sheet 64)
(Joins sheet 66)
(Joins sheet 72)
R. 22 W.
R. 21 W.
T. 94 N.
2 020 000 FEET
2 035 000 FEET
540 000 FEET
535 000 FEET
West Branch
Beaverdam
Creek
Drainage
Ditch 70
1 Mile
5 000 Feet
Scale 1:15 840

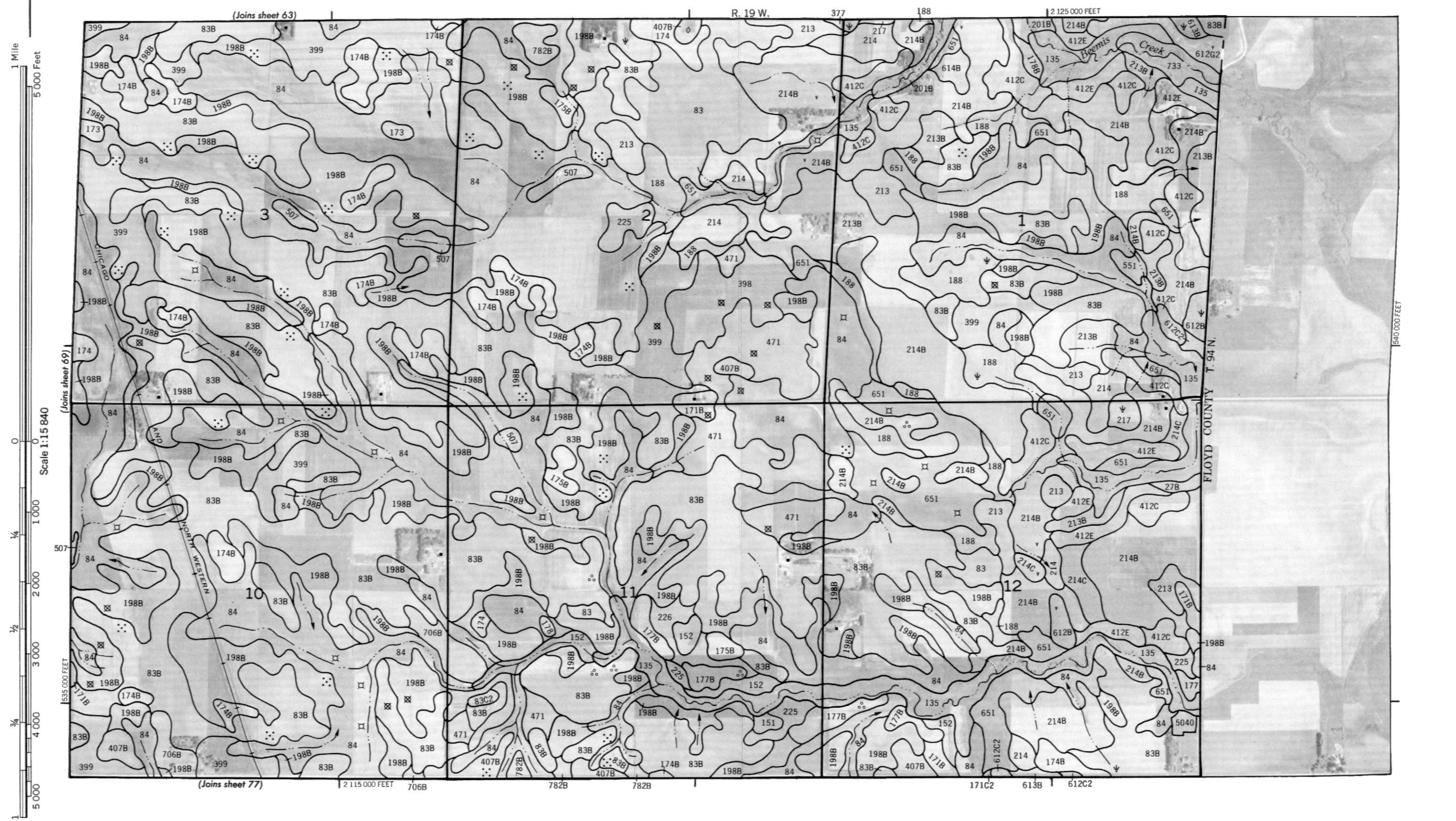
CERRO GORDO COUNTY, IOWA — SHEET NUMBER 66

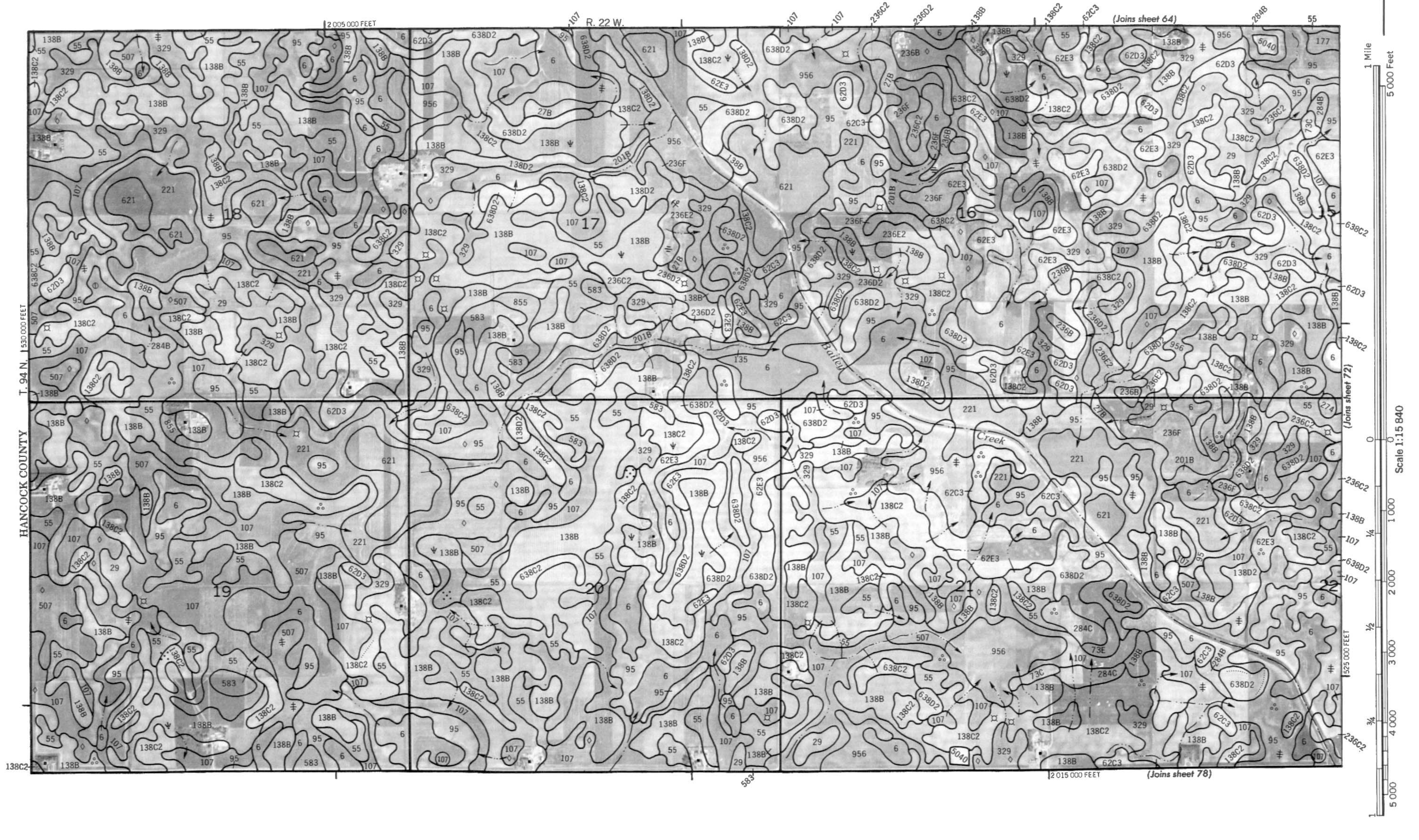


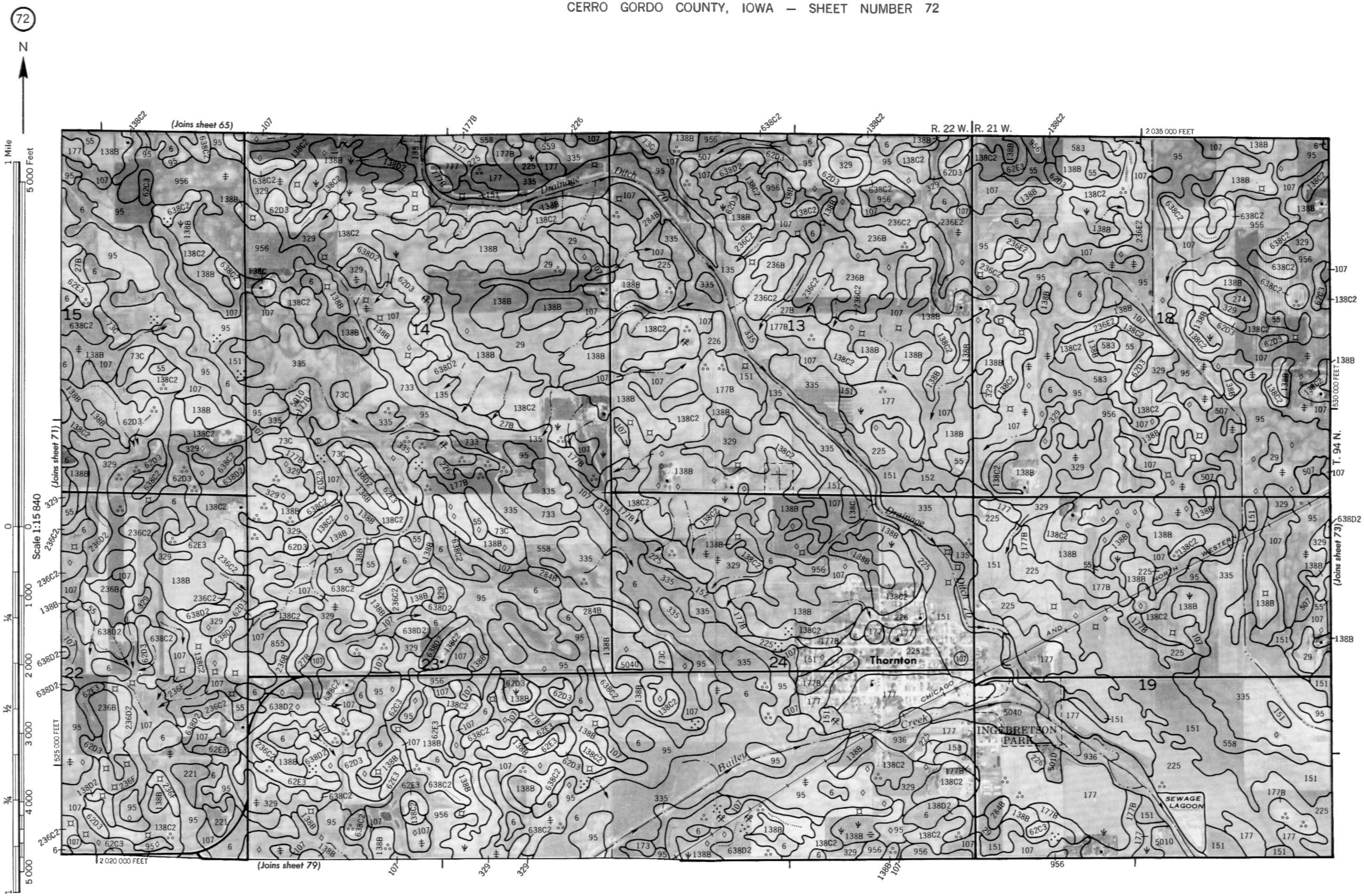

N
(Joins sheet 60)
(Joins sheet 68)
(Joins sheet 74)
(Joins sheet 66)
R. 21 W.
R. 20 W.
T. 94 N.
2 050 000 FEET
2 070 000 FEET
540 000 FEET
535 000 FEET
Beaverdam Creek
Drainage Ditch 92
CHICAGO ROCK ISLAND AND PACIFIC
1 Mile
5 000 Feet
Scale 1:15 840

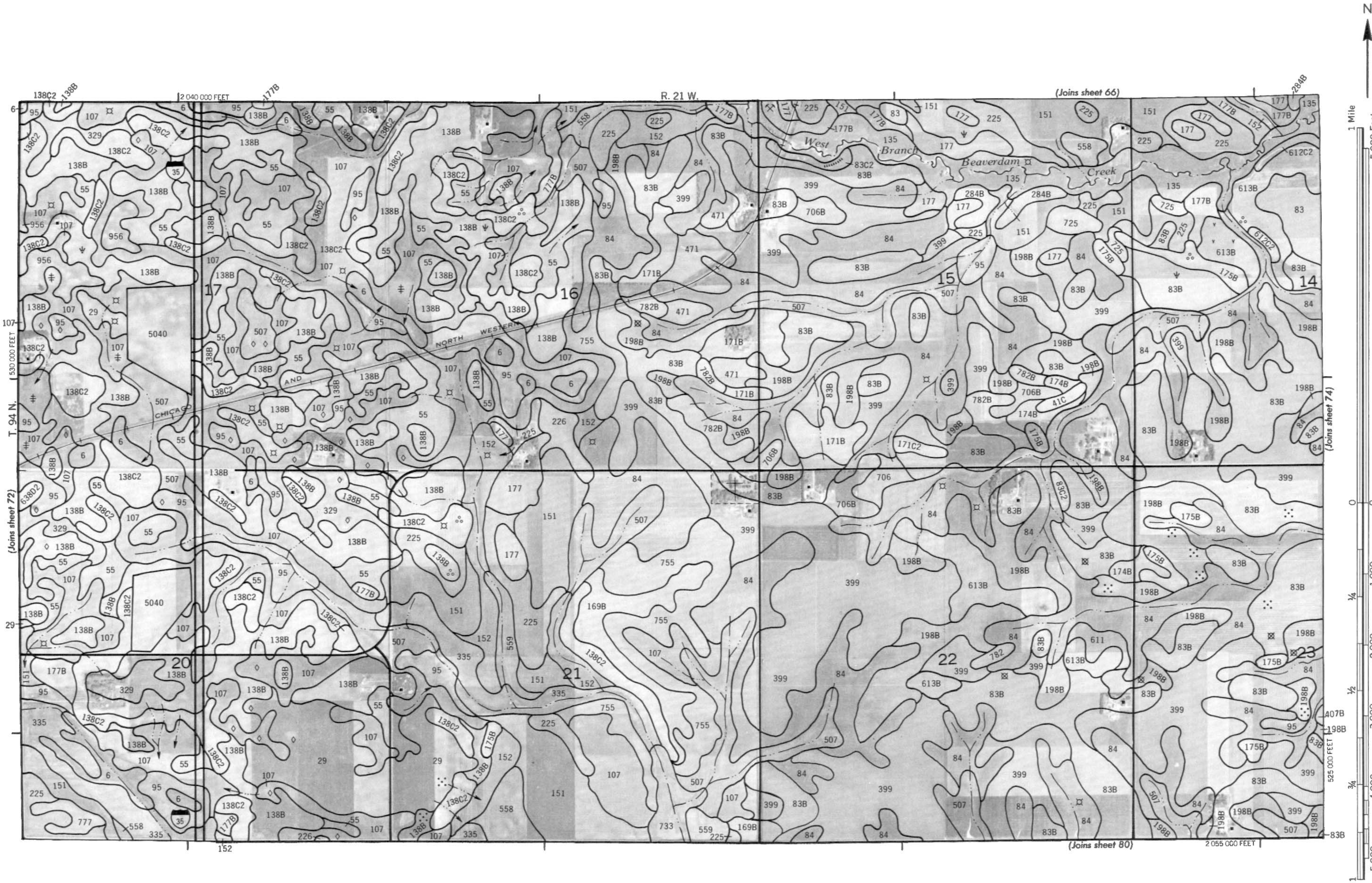

68
N
(Joins sheet 61)
(Joins sheet 67)
(Joins sheet 69)
(Joins sheet 75)
R. 20 W.
T. 94 N.
2 090 000 FEET
540 000 FEET
535 000 FEET
2 075 000 FEET
Rockwell
LINN GROVE PARK
EAST BRANCH
BEAVER DAM CREEK
CHICAGO AND NORTH WESTERN
Scale 1:15 840
1 Mile
5 000 Feet


69
N
R. 20 W.
R. 19 W.
2 095 000 FEET
225 (Joins sheet 62)
Cartersville
T. 94 N.
540 000 FEET
(Joins sheet 68)
(Joins sheet 70)
535 000 FEET
(Joins sheet 76)
2 110 000 FEET
Coldwater Creek
Coldwater Creek
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

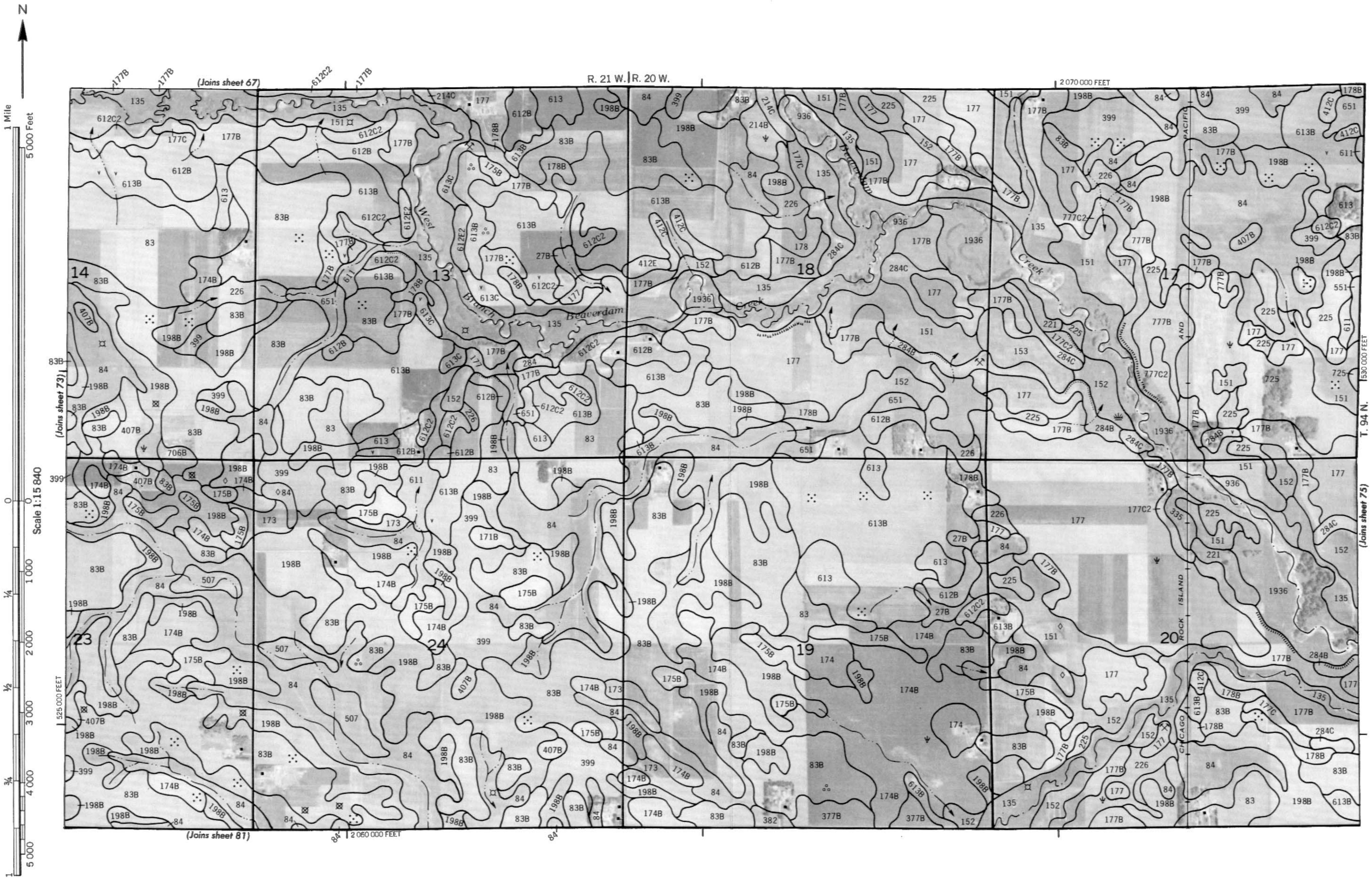

70
N
(Joins sheet 63)
R. 19 W.
2 125 000 FEET
(Joins sheet 69)
(Joins sheet 77)
2 115 000 FEET
535 000 FEET
540 000 FEET
T. 94 N.
FLOYD COUNTY
CHICAGO AND NORTH WESTERN
Beemis Creek
Scale 1:15 840
1 Mile
5 000 Feet

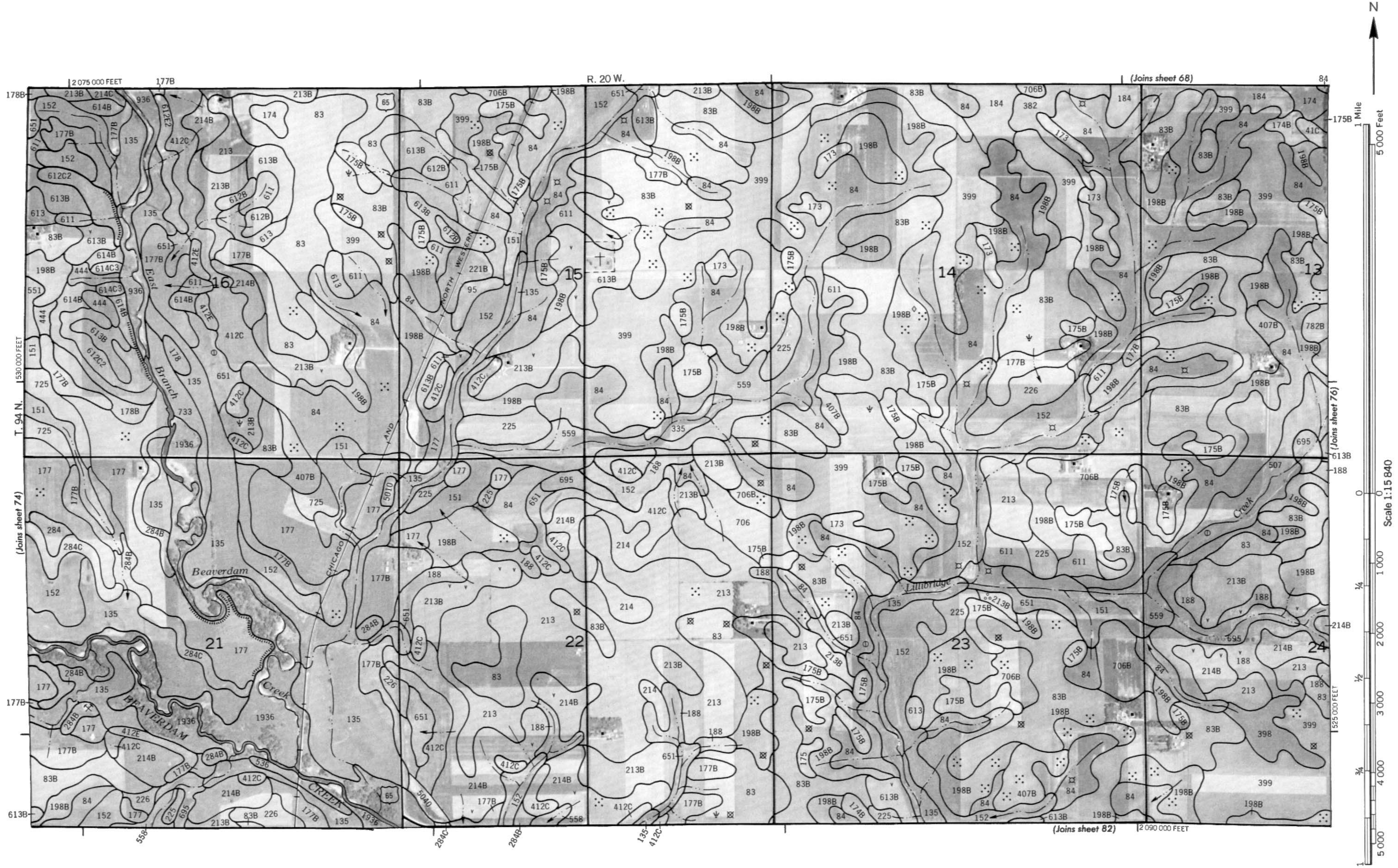

N
R. 22 W.
T. 94 N.
HANCOCK COUNTY
(Joins sheet 64)
(Joins sheet 72)
(Joins sheet 78)
2 005 000 FEET
2 015 000 FEET
530 000 FEET
525 000 FEET
Bailey
Creek
17
16
15
18
19
20
21
22
1 Mile
5 000 Feet
Scale 1:15 840


72
N
(Joins sheet 65)
(Joins sheet 71)
(Joins sheet 73)
(Joins sheet 79)
R. 22 W.
R. 21 W.
T. 94 N.
2 035 000 FEET
530 000 FEET
525 000 FEET
2 020 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
Drainage
Ditch
Bailey
Creek
CHICAGO
AND
NORTH
WESTERN
Thornton
INGEBRETSON
PARK
SEWAGE
LAGOON
15
14
13
18
22
23
24
19

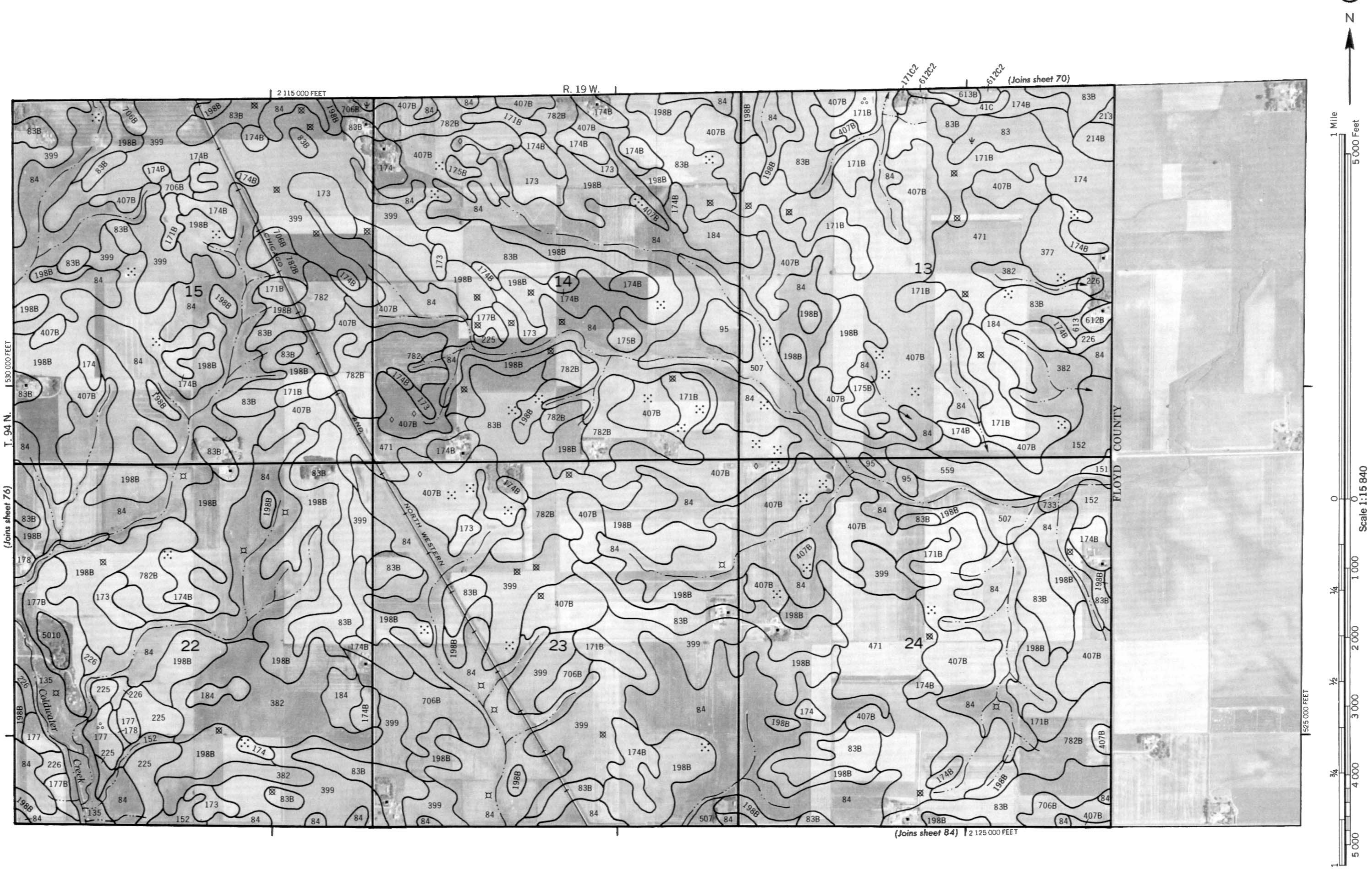

N
(Joins sheet 66)
R. 21 W.
T. 94 N.
(Joins sheet 72)
(Joins sheet 74)
(Joins sheet 80)
2 040 000 FEET
2 055 000 FEET
530 000 FEET
525 000 FEET
West Branch Beaverdam Creek
CHICAGO AND NORTH WESTERN
17
16
15
14
20
21
22
23
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000

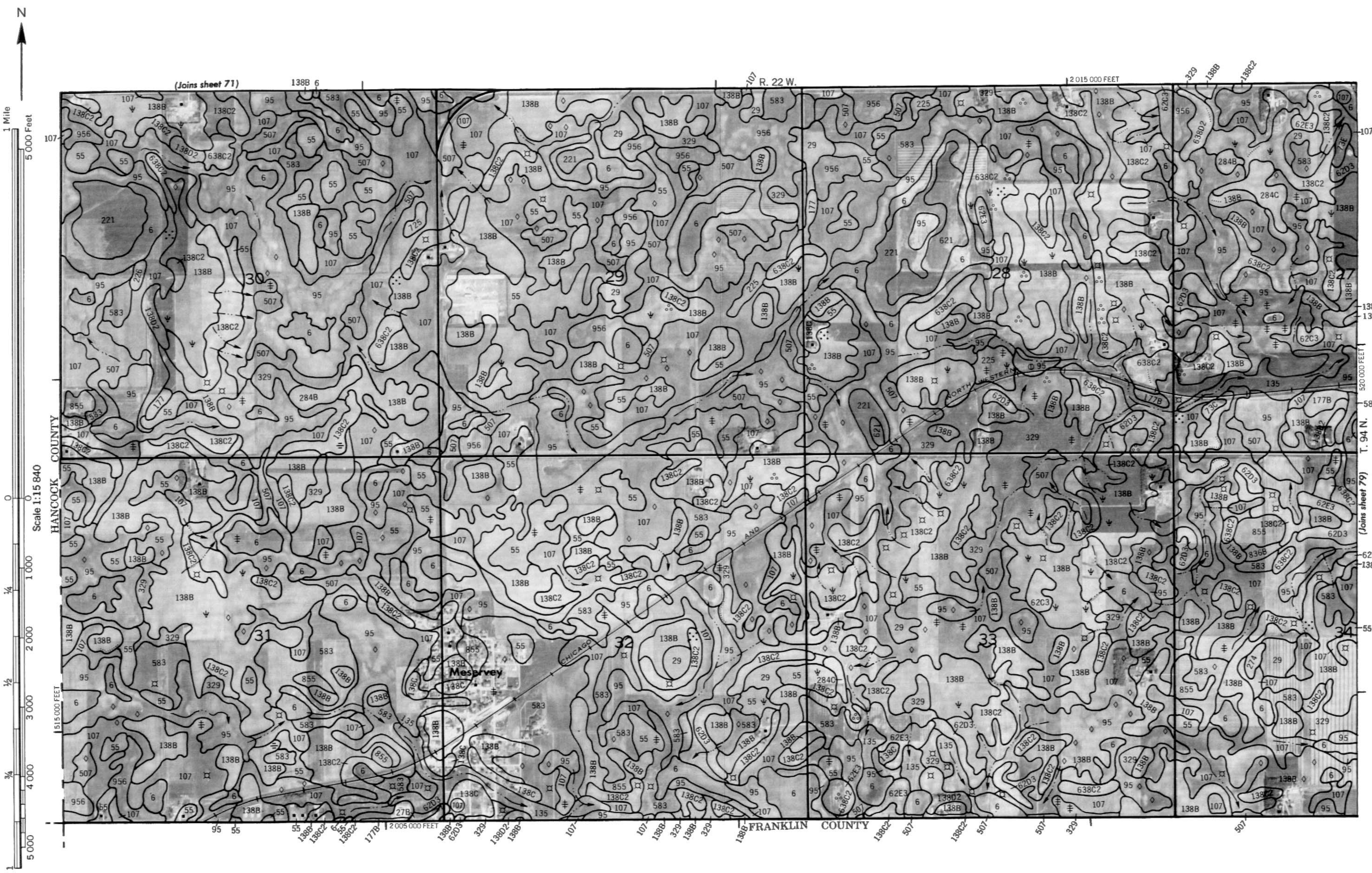
74

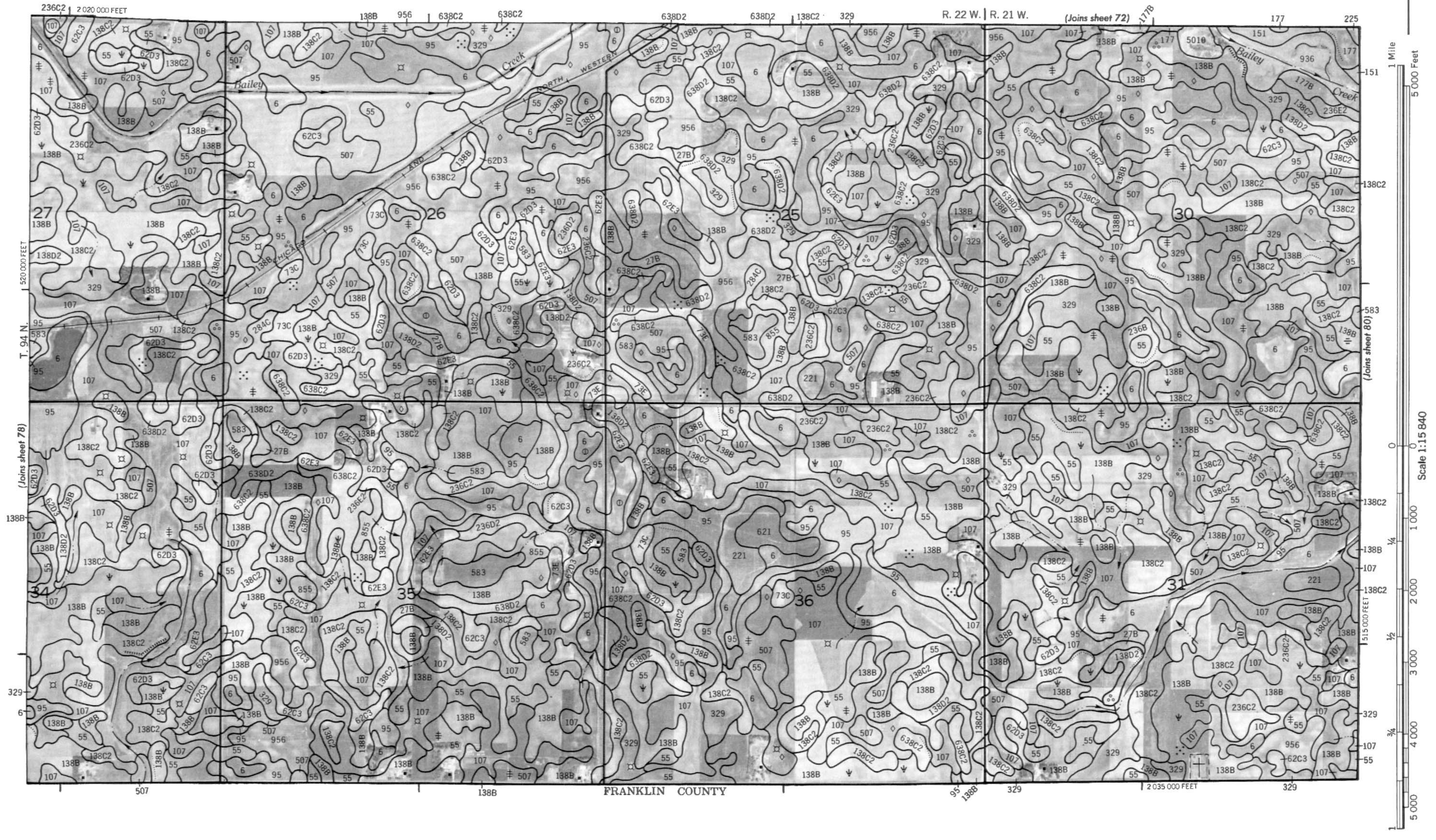

N
(Joins sheet 67)
(Joins sheet 73)
(Joins sheet 75)
(Joins sheet 81)
R. 21 W.
R. 20 W.
T. 94 N.
2 070 000 FEET
2 060 000 FEET
530 000 FEET
525 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
West Branch Beaverdam Creek
Beaverdam Creek
CHICAGO ROCK ISLAND AND PACIFIC
13
14
17
18
19
20
23
24


N
R. 20 W.
T. 94 N.
2 075 000 FEET
2 090 000 FEET
530 000 FEET
525 000 FEET
(Joins sheet 68)
(Joins sheet 74)
(Joins sheet 76)
(Joins sheet 82)
East Branch
Beaverdam
Beaverdam Creek
BEAVERDAM CREEK
Lillibridge Creek
CHICAGO AND NORTH WESTERN
65
16
15
14
13
21
22
23
24
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

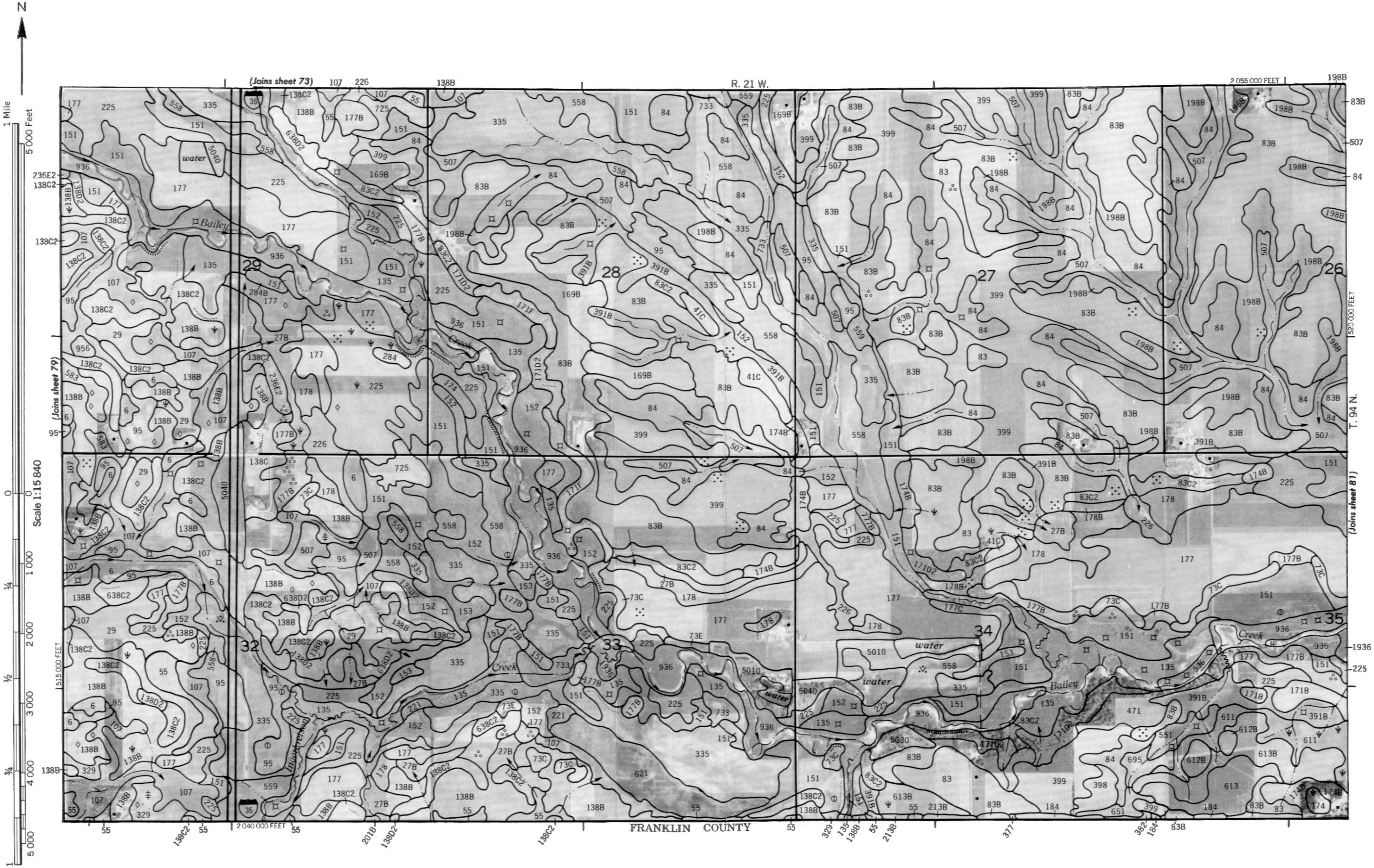

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 69)
R. 20 W.
R. 19 W.
2 110 000 FEET
(Joins sheet 75)
(Joins sheet 77)
T. 94 N.
530 000 FEET
525 000 FEET
(Joins sheet 83)
2 095 000 FEET
Coldwater
Creek
Coldwater
Creek
13
18
17
16
24
19
20
21

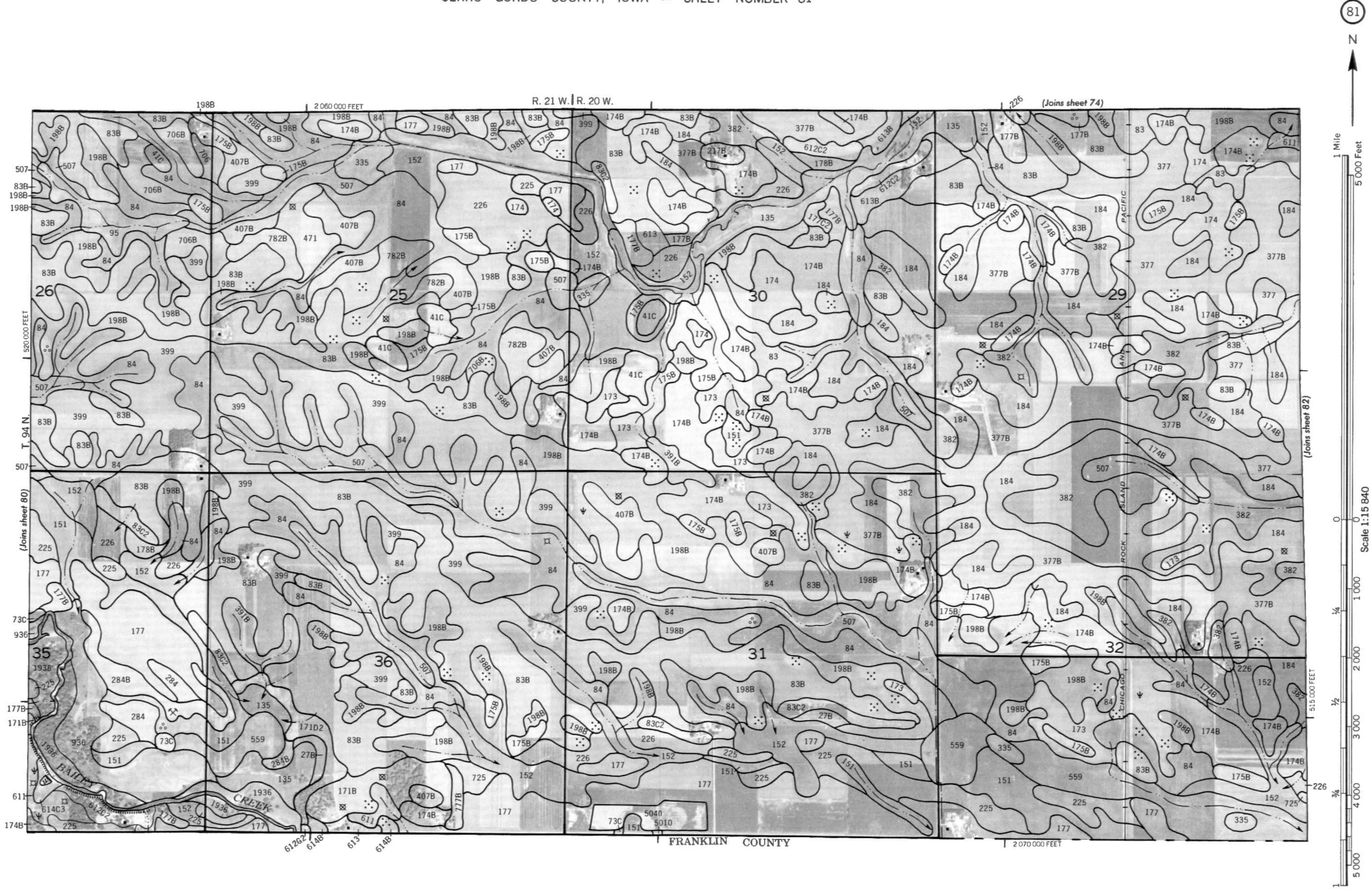

77
N
(Joins sheet 70)
(Joins sheet 76)
(Joins sheet 84)
R. 19 W.
T. 94 N.
2 115 000 FEET
2 125 000 FEET
530 000 FEET
525 000 FEET
FLOYD COUNTY
CHICAGO AND NORTH WESTERN
Coldwater Creek
15
14
13
22
23
24
1 Mile
5 000 Feet
Scale 1:15 840

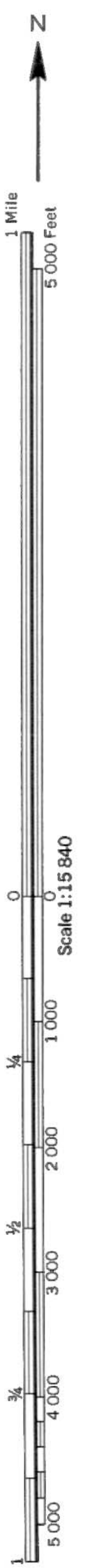

N
(Joins sheet 71)
R. 22 W.
2 015 000 FEET
T. 94 N.
520 000 FEET
(Joins sheet 79)
HANCOCK COUNTY
FRANKLIN COUNTY
2 005 000 FEET
515 000 FEET
Meservey
NORTH WESTERN
CHICAGO AND
1 Mile
5 000 Feet
Scale 1:15 840
30
29
28
27
31
32
33
34

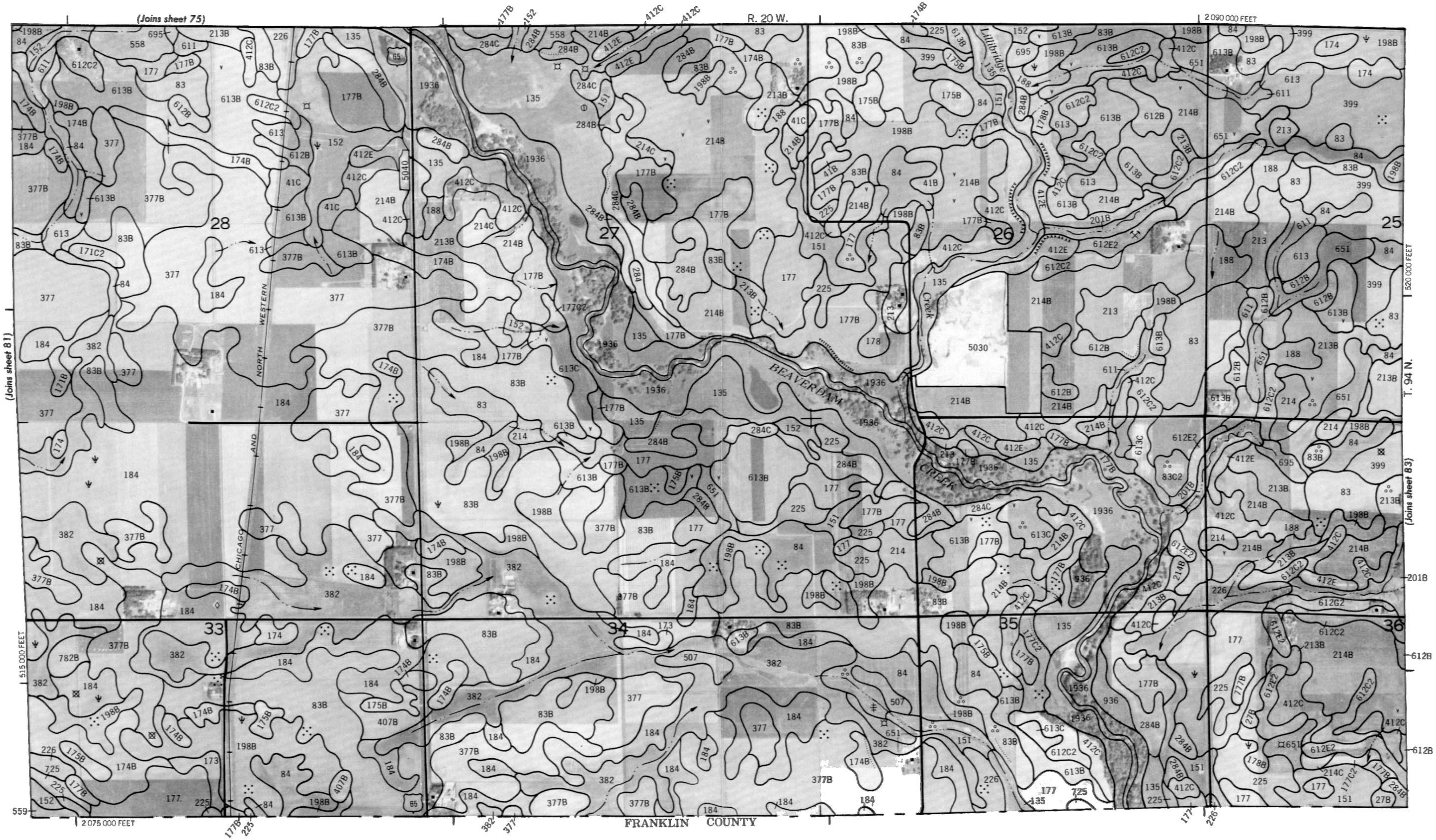


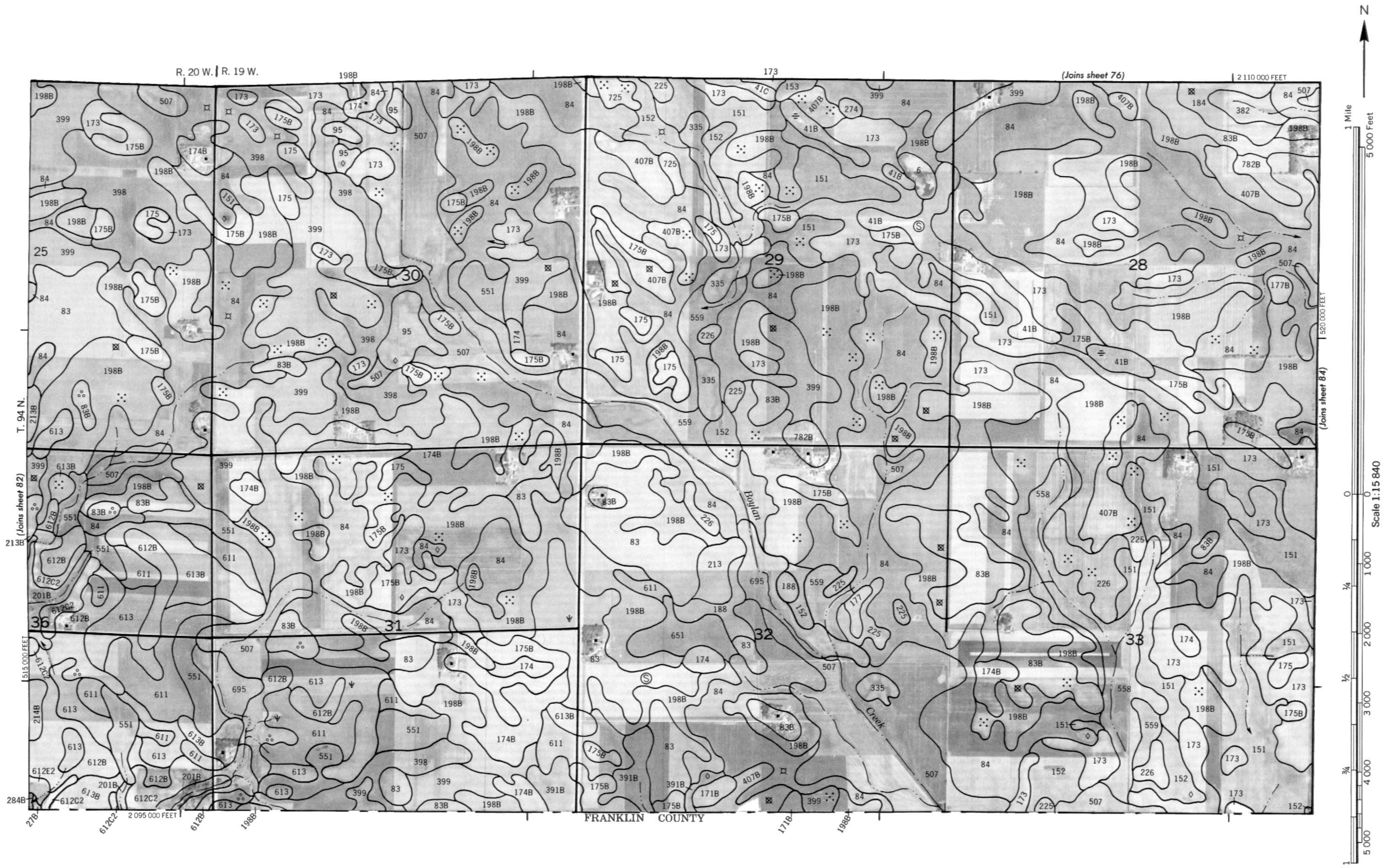
N
2 020 000 FEET
R. 22 W.
R. 21 W.
(Joins sheet 72)
(Joins sheet 78)
(Joins sheet 80)
T. 94 N.
520 000 FEET
515 000 FEET
2 035 000 FEET
FRANKLIN COUNTY
Bailey
Creek
CHICAGO AND NORTH WESTERN
27
26
25
30
34
35
36
31
1 Mile
5 000 Feet
Scale 1:15 840

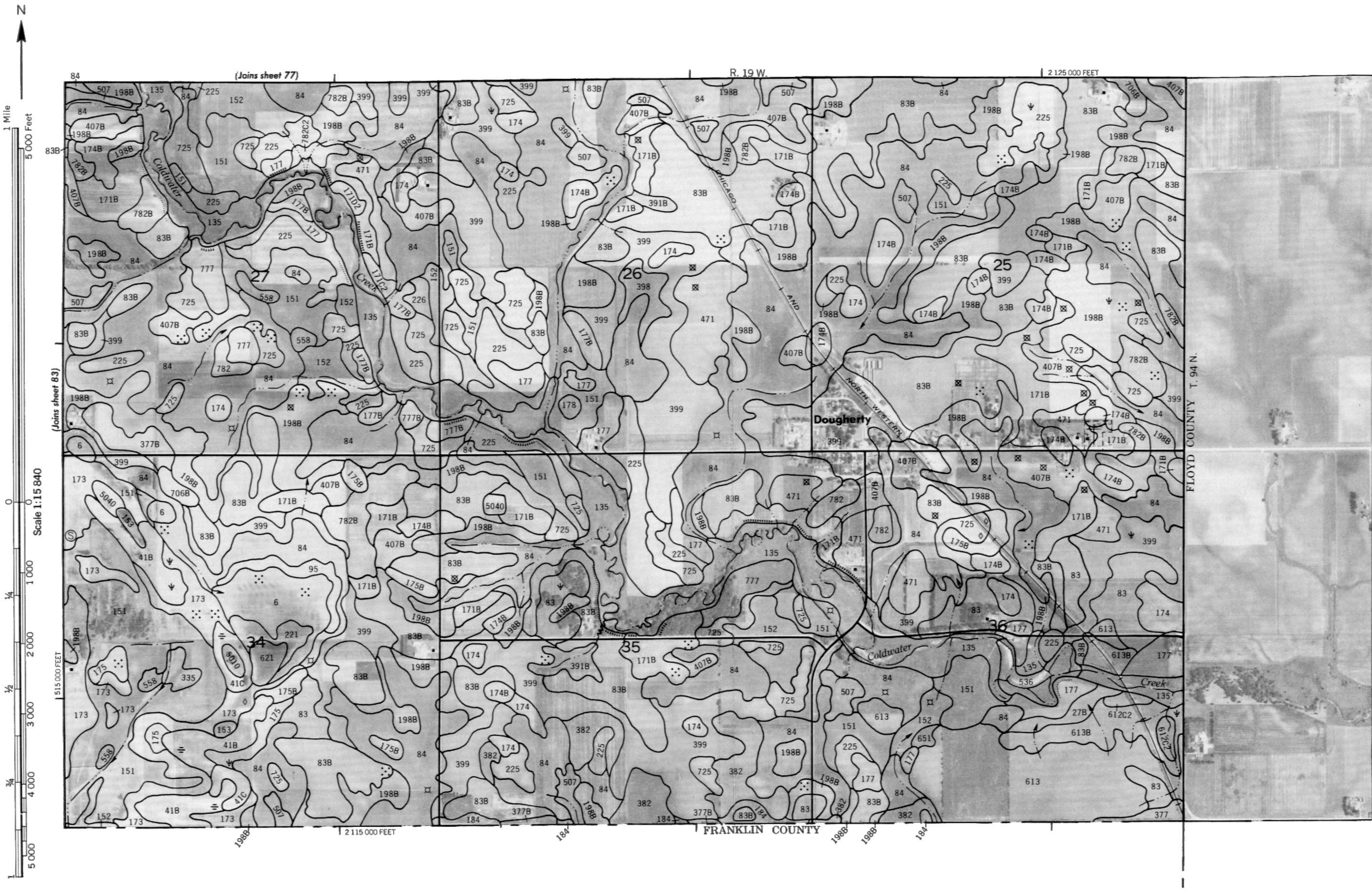

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 73)
(Joins sheet 79)
(Joins sheet 81)
R. 21 W.
T. 94 N.
2 055 000 FEET
2 040 000 FEET
520 000 FEET
515 000 FEET
FRANKLIN COUNTY
Bailey
Creek
Bailey Creek
water
28
27
26
29
32
33
34
35


81
N
R. 21 W.
R. 20 W.
2 060 000 FEET
2 070 000 FEET
520 000 FEET
515 000 FEET
(Joins sheet 74)
(Joins sheet 80)
(Joins sheet 82)
T. 94 N.
FRANKLIN COUNTY
BAILEY CREEK
CHICAGO ROCK ISLAND AND PACIFIC
26
25
30
29
35
36
31
32
1 Mile
5 000 Feet
Scale 1:15 840


N
1 Mile
5 000 Feet
0
Scale 1:15 840
1 000
1/4
2 000
1/2
3 000
3/4
4 000
5 000
1


(Joins sheet 75)
R. 20 W.
2 090 000 FEET
(Joins sheet 81)
(Joins sheet 83)
T. 94 N.
520 000 FEET
515 000 FEET
2 075 000 FEET
CHICAGO AND NORTH WESTERN
Lillibridge Creek
BEAVERDAM CREEK
FRANKLIN COUNTY
28
27
26
25
33
34
35
36


N
R. 20 W.
R. 19 W.
(Joins sheet 76)
2 110 000 FEET
(Joins sheet 82)
(Joins sheet 84)
T. 94 N.
520 000 FEET
515 000 FEET
2 095 000 FEET
25
30
29
28
36
31
32
33
Boylan
Creek
FRANKLIN COUNTY
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾


N
(Joins sheet 77)
R. 19 W.
2 125 000 FEET
(Joins sheet 83)
520 000 FEET
515 000 FEET
2 115 000 FEET
FLOYD COUNTY
T. 94 N.
FRANKLIN COUNTY
Dougherty
Coldwater Creek
CHICAGO AND NORTH WESTERN
27
26
25
34
35
36
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1